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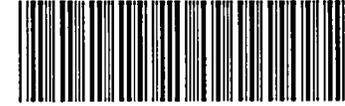
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PROGRESS ENERGY  
CRYSTAL RIVER UNIT 3  
PLANT OPERATING MANUAL

**CH-632**

**Post Accident Sampling and Analysis of Reactor Coolant, Decay Heat,  
Reactor Building Sump, and Miscellaneous Waste Storage Tank**

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1.0 **PURPOSE**

This procedure provides instructions for sampling RCS, DH, MWST, and RB sump during accident conditions using PASS.

2.0 **REFERENCES**

2.1 **Developmental References**

- 2.1.1 APEX Technologies Post Accident Sample System Modules Manual, FPC Manual #2034
- 2.1.2 EOP-14, Enclosure 2, PPO Post Event Actions
- 2.1.3 FD-302-700, Post Accident Sampling System
- 2.1.4 Nuclear Regulatory Commission RTM-96, Response Technical Manual
- 2.1.5 NUREG 0737, Post-TMI Requirements
- 2.1.6 PASS Users Manual Volumes A through C, Crystal River Installation
- 2.1.7 Radiological Emergency Response Plan
- 2.1.8 Regulatory Guide 1.183, Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors. July 2000
- 2.1.9 Regulatory Guide 1.97, Instrumentation for Light-Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident
- 2.1.10 RSP-600, ALARA Program
- 2.1.11 EM-104, Operation of the Operational Support Center
- 2.1.12 CH-234, Post Accident Sampling System Gamma Spectroscopy System
- 2.1.13 6059-S-002, APEX Technologies PASS Process Flow Diagrams
- 2.1.14 NUREG 1465, Accident Source Terms for Light-Water Nuclear Power Plants, Feb. 1995

## 2.2

## Equipment Database References

CAV-1	CAV-439	CAV-492	CAV-631	CASB-5
CAV-3	CAV-440	CAV-493	CAV-632	CAP-8
CAV-126	CAV-441	CAV-500	CAV-633	CAP-10
DWV-337	CAV-442	CAV-519	CAV-634	CAP-13
CAV-429	CAV-443	CAV-525	CAV-635	CAP-14
CAV-430	CAV-444	CAV-623	CAV-636	CAT-8
CAV-431	CAV-445	CAV-624	AHF-55	DPDP-5A
CAV-432	CAV-446	CAV-625	CA-54-CE	DPDP-5B
CAV-433	CAV-447	CAV-626	CA-54-CX	WDP-6A
CAV-434	CAV-448	CAV-627	CA-54-LT	WDP-6B
CAV-435	CAV-470	CAV-628	CA-56-CI	WDT-4
CAV-436	CAV-471	CAV-629	CA-74-FI	ACDP-59
CAV-437	CAV-484	CAV-630	CACP-1	CAV-702
CAV-491	CAV-493	CA-50-FS	CAV-703	CAV-704
CAV-705	CA-94-PI	CAV-699	CA-55-CI	CA-78-FI
CA-73-CI	CA-76-PI	CA-89-PI	CA-77-PI	CAV-669

### 3.0 PERSONNEL INDOCTRINATION

#### 3.1 Description

- 3.1.1 PASS is an on-line system designed to sample various liquid and gaseous sample streams during accident conditions.
- 3.1.2 The liquid PASS system consists of an AIMS detector to perform gamma isotopic analysis of the sample streams.
- 3.1.3 The PASS system provides the ability to obtain liquid grab samples to be shipped off-site for analysis.
- 3.1.4 The PASS system has the ability to analyze boron, dissolved hydrogen, chloride, pH, and gamma isotopic from RCS at high pressure. This sample may be obtained from RC letdown, pressurizer water space, pressurizer steam space, RCP-1A discharge, or RCP-1C suction.
- 3.1.5 The PASS system has the ability to analyze boron and gamma isotopic on low pressure systems. These systems include DH, RB sump, and MWST.
- 3.1.6 When estimating total activity for liquid grab sample shipment, the following assumptions were made:
- Core Nuclide Mix and Half-lives from RADTRAD Code Library
  - 8 hours since reactor shutdown
  - Microshield software was used to determine conversion factors for calculating total  $\mu\text{Ci}$  from dose rate. Sample assumed to be small enough at 7 inches to represent point source. Pig is 17.75 inches tall with diameter of 7 inches. Weight is 725 pounds. This results in effective density of 7.4 g/cc.
  - Release fractions from Regulatory Guide 1.183 for gap and early in-vessel melt
  - Assume no noble gas remain in unpressurized RCS/sump sample
- 3.1.7 When estimating core damage based on RCS sample (Enclosure 5), the following assumptions were made:
- Factor (B) is 1300 based on the following:  
$$\begin{aligned} \text{Assumed dilution mass} &= 1.3\text{E}9 \text{ grams} \\ 1300 &= (1.3\text{E}9 \text{ grams}) \times (1\text{E}-6 \text{ Ci}/\mu\text{Ci}) \end{aligned}$$
  - Core Inventory (D) is from RADTRAD library for 2619 MWth core
  - Expected fraction in gap (F) is from NUREG 1465
  - Expected in-vessel melt release fraction 100% melt (G) is from NUREG-1465

## 3.2 Definitions

- 3.2.1 AIMS Automated Isotopic Measurement System
- 3.2.2 EC Emergency Coordinator
- 3.2.3 PASS Post Accident Sampling System
- 3.2.4 RE-ENTRY Return of personnel to an area evacuated by an emergency condition
- 3.2.5 RMT Radiation Monitoring Team
- 3.2.6 TMI Three Mile Island nuclear power plant
- 3.2.7 IRP Instrument Relay Panel

## 3.3 Responsibilities

- 3.3.1 EC or designee shall authorize re-entry.
- 3.3.2 OSC Chemistry Coordinator
- Ensures EC approval for re-entry has been obtained
  - Determines which sections of procedure are to be performed during re-entry
  - Ensures re-entry prerequisites are complete
- 3.3.3 This procedure is performed by a qualified Emergency Sample Team member.

## 3.4 Limits and Precautions

- 3.4.1 Any or all of this procedure is done by direction of the EC or designee.
- 3.4.2 Re-entry must have RMT preplanning, concurrence, and coverage as outlined in EM-104, Operation of the Operational Support Center. Controlled access areas will be defined by the RMT personnel.
- 3.4.3 Extremely high radiation dose rates may be present during post-accident sampling. These high dose rates could result in high radiation exposure. Performing this procedure requires ALARA pre-planning.
- 3.4.4 Emergency Sample Team will STOP and go to a low dose area (i.e. primary chemistry laboratory) if dose rates at re-entry work area exceeds limits specified in pre-job briefing.
- 3.4.5 All sampling actions are performed from the Main Control Board by Operations or from the Count Room unless specifically noted.

- 3.4.6 CAT-8 HI-HI level has the following interlocks:
- CAV-623 closes
  - CAV-627 closes
  - CAP-10 stops
- 3.4.7 Pressure > 175 psig at CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. These relief valves open at approximately 200 psig.
- 3.4.8 Pressure > 30 psig at CA-94-PI may cause relief valve CAV-705 to open. This relief valve opens at approximately 50 psig.
- 3.4.9 Relief valves CAV-702, CAV-705, and CAV-491 discharge to the MWST. Lifting these relief valves may cause increased dose rates in the AB.
- 3.4.10 Pressure > 100 psig at CA-77-PI may cause relief valve CAV-669 to open. This relief valve opens at approximately 110 psig.
- 3.4.11 Sample is flushed through the boronometer at least 2 hours before obtaining boron results.
- 3.4.12 Sample is flushed through the hydrogen and pH analyzers at least 15 minutes before obtaining results.
- 3.4.13 Sampling described in Section 4.0 of this procedure CANNOT be performed concurrently due to shared piping in the different sample streams.
- 3.4.14 IC QC check limit is  $\pm 25\%$  of expected value.
- 3.4.15 Low range hydrogen analyzer analytical range is 0-200 cc/kg. High range hydrogen analyzer analytical range is 200-2000 cc/kg.
- 3.4.16 Sampling any of the low pressure systems for the first time requires an entry into the PASS room (95' AB) to reposition CAV-701 to PORT 2 which could result in high radiation exposure. CAV-701 is normally positioned to PORT 1. Once positioned to PORT 2, the valve will remain in that position to avoid re-entry into a potentially high dose area.
- 3.4.17 The RB sump ALTERNATE sample point returns water to the MWST which could result in increased radiation levels in the AB.
- 3.4.18 Using the RB sump ALTERNATE sample point requires an entry into 95' IB to open CAV-500 which could result in high radiation exposure. A second re-entry is required to close the valve when securing the line-up.

3.5 Prerequisites

<b>NOTE</b>  Prerequisite steps may be performed in an order.
---

3.5.1 ASSEMBLE sample team.

Sample Team Leader \_\_\_\_\_

Sample Team Members \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3.5.2 DETERMINE sampling to be performed.

Section Number

Description

Section Number	Description
_____	_____
_____	_____
_____	_____
_____	_____

3.5.3 REVIEW procedures.

- \_\_\_ EM-104, Operation of Operational Support Center
- \_\_\_ Emergency Team Member duties per Section 4.0
- \_\_\_ Team Briefing/Re-entry checklist
- \_\_\_ Sections of this procedure being performed

3.5.4 IF grab sample to be performed via CASB-2,  
THEN ENSURE the following:

Grab sampler currently installed

OR

Grab sampler NOT currently installed

\_\_\_ New break-away type device available to attach transit cover and transit cover bolts to sampler

\_\_\_ Replacement sample bomb (Catalog ID 1400513) available to install on grab sampler transit cart

3.5.5 ENSURE electrical breakers are closed.

Operations has performed EOP-14 Enclosure 2, PPO Post Event Actions

OR

Operations has NOT performed EOP-14 Enclosure 2, PPO Post Event Actions

1. \_\_\_ REQUEST Operations CLOSE the following breakers

- DPDP-5A Breaker 27 (CAV-433, CAV-434, CAV-429, CAV-430).

- DPDP-5B, Breaker 8 (CAV-432, CAV-435, CAV-436)

2. \_\_\_ Operations REPORTS breakers closed

3.5.6 IF sample a low pressure system,

- DH
- MWST
- RB sump

THEN DETERMINE position of CAV-701

Low pressure system has NOT been sampled using PASS. CAV-701 is positioned to PORT 1. An entry into the PASS room (95' AB) is required to position CAV-701 to PORT 2. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located MIDDLE LEFT SIDE inside CAX-1 approximately head high.

OR

Low pressure system HAS been sampled using PASS. CAV-701 was positioned to PORT 2 at that time and left in that position

3.5.7 IF sampling RB sump using ALTERNATE sample path,  
THEN DISCUSS the following:

- \_\_\_ RB sump water will be pumped to MWST. This action could cause increased radiation levels in AB
- \_\_\_ 2 entries into 95' IB will be required to OPEN and subsequently CLOSE CAV-500. Operating CAV-500 could result in increased dose exposure
- \_\_\_ CAV-500 is located inside IB approximately 15' from IB door (about 3' past OTSG sample valve manifold) on left about 7' above floor

3.5.8 IF sampling MWST,  
THEN REQUEST Operations perform the following:

1. START MWST recirculation pump.
  - WDP-6A
  - OR
  - WDP-6B
2. \_\_\_ Operations REPORTS MWST recirculation pump RUNNING

3.5.9 PERFORM pre-job brief.

- \_\_\_ ENSURE RMT member is present for briefing
- \_\_\_ DISCUSS the following
  - \_\_\_ access route
  - \_\_\_ exit route
  - \_\_\_ Communications
  - \_\_\_ Radio channel to be used \_\_\_\_\_

phone number(s) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3.5.10 VERIFY ALL steps of this section are completed before sample team leaves OSC.

Section 3.5 Complete \_\_\_/\_\_\_  
Initial/Date

4.0 INSTRUCTIONS

4.1 Reactor Coolant Gamma Isotopic or Boron Analysis

4.1.1 VERIFY radio communication.

\_\_\_ WHEN sample team exits OSC,  
\_\_\_ THEN VERIFY radio communication with OSC Chemistry Coordinator or  
designee

4.1.2 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF

2. CLOSE the following valves

\_\_\_ CAV-439

\_\_\_ CAV-636

3. OPEN the following valves

\_\_\_ CAV-519

\_\_\_ CAV-447

\_\_\_ CAV-448

4. POSITION the following valves

\_\_\_ CAV-623 to SAMPLE

\_\_\_ CAV-625 to SAMPLE

\_\_\_ CAV-626 to DRAIN TANK

4.1.3 REQUEST Operations OPEN containment isolation valves.

1. OPEN sample isolation valve
  - CAV-126 (Reactor Coolant Letdown)
  - OR
  - CAV-429 (RCP-1A Discharge)
  - OR
  - CAV-430 (RCP-1C Suction)
2. OPEN PASS Containment isolation valve
  - CAV-431 (normal AIMS supply)
  - OR
  - CAV-432 (alternate AIMS supply)
3. OPEN RB sump return isolation valves
  - CAV-436
  - CAV-434
4.  Operations REPORTS valves OPEN

4.1.4 ALIGN CAT-8.

- SELECT CAP-10 control switch to AUTO
- START CAP-14

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

### NOTE

Relief valves CAV-702, CAV-705, and CAV-491 discharge to the MWST. Flow downstream of these valves is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

#### 4.1.5 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ DEPRESS CA-74-FI RESET button to zero flow totalizer. REFER to Enclosure 6.
3. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

#### 4.1.6 DETERMINE status of RC letdown flow from Operations.

RC letdown flow secured

OR

RC letdown flow lined up

**NOTE**

Procedure may continue while flushing sample.

4.1.7 FLUSH sample lines. Total flush volume is indicated using CA-74-FI totalizer reading. REFER to Enclosure 6.

CAV-126 open (RC Letdown secured) – FLUSH at least 45 gallons

OR

CAV-126 open (RC letdown lined up) – FLUSH at least 17.5 gallons

OR

CAV-429 open (RCP-1A discharge) – FLUSH at least 3 gallons

OR

CAV-430 open (RCP-1C suction) – FLUSH at least 3 gallons

4.1.8 ENSURE the following temperatures are maintained. REFER to Enclosure 2.

\_\_\_ CA-54 TE-1 RCS < 120 °F

\_\_\_ CA-51 TE WATER < 100 °F

4.1.9 IF gamma isotopic analysis is to be performed,  
THEN ENSURE PASS AIMS detector CA-54-CE ready for use.

\_\_\_ REFER to Enclosure 3 for guidance

Liquid nitrogen dewar > 50 pounds

Detector voltage adjusted

QC requirements met

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

**NOTE**

Enclosure 5 may be used to evaluate % core damage

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently.

4.1.10

IF gamma isotopic analysis is to be performed,  
THEN PERFORM the following:

1.  VERIFY minimum sample flush complete
2. REFER to Enclosure 4 for gamma isotopic analysis  
 SELECT applicable sample point  
 Reactor Coolant Letdown Sample  
OR  
 RCP-1A Discharge Sample  
OR  
 RCP-1C Suction Sample
3.  ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.1.11

IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

#### 4.1.12 ALIGN for demineralized water flush.

1. NOTIFY Operations to CLOSE containment isolation valves
  - a. CLOSE sample isolation valve
    - CAV-126 (Reactor Coolant Letdown)
    - OR
    - CAV-429 (RCP-1A Discharge)
    - OR
    - CAV-430 (RCP-1C Suction)
  - b. CLOSE PASS Containment isolation valve
    - CAV-431 (normal AIMS supply)
    - OR
    - CAV-432 (alternate AIMS supply)
  - c. \_\_\_ Operations REPORTS valves closed
2. OPEN the following demineralized water supply valves
  - \_\_\_ DWV-337
  - \_\_\_ CAV-470
3. \_\_\_ THROTTLE CAV-484 to obtain 0.35-0.50 gpm at CA-74-FI

4.1.13 ENSURE adequate system purge.

1.  ENSURE logged onto PASS computer
2.  ENSURE PASS Menu selected
3.  SELECT Flush Sample Lines
4.  SELECT RCS Demin Flush
5.  FLUSH at least 10 minutes
6.  PRESS ENTER when flush is complete
7.  SELECT Quit to exit
8.  ENTER LO to log off PASS

4.1.14 SECURE line-up.

1.  STOP CAP-14
2.  SELECT CAP-10 control switch to OFF
3. CLOSE demineralized water supply valves
  - DWV-337
  - CAV-470
4. CLOSE the following valves
  - CAV-519
  - CAV-447
  - CAV-448
  - CAV-484
  - CAV-623
  - CAV-625
  - CAV-626
5. NOTIFY Operations to CLOSE the following valves
  - CAV-436
  - CAV-434

4.1.15 RESTORE normal configuration.

1.  OPEN CAV-439
2.  OPEN CAV-636
3.  SELECT CAP-10 control switch to AUTO

Section 4.1 Complete     /      
Initial/Date

4.2 Reactor Coolant Gamma Isotopic, Boron, Hydrogen, or pH Analysis

4.2.1 VERIFY radio communication.

\_\_\_ WHEN sample team exits OSC,  
\_\_\_ THEN VERIFY radio communication with OSC Chemistry Coordinator or  
designee

4.2.2 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF

2. CLOSE the following valves

\_\_\_ CAV-439

\_\_\_ CAV-636

3. OPEN the following valves

\_\_\_ CAV-519

\_\_\_ CAV-447

\_\_\_ CAV-448

4. POSITION the following valves

\_\_\_ CAV-623 to SAMPLE

\_\_\_ CAV-625 to SAMPLE

\_\_\_ CAV-626 to DRAIN TANK

4.2.3 REQUEST Operations OPEN containment isolation valves.

1. OPEN sample isolation valve

CAV-126 (Reactor Coolant Letdown)

OR

CAV-429 (RCP-1A Discharge)

OR

CAV-430 (RCP-1C Suction)

2. OPEN PASS Containment isolation valve

CAV-431 (normal AIMS supply)

OR

CAV-432 (alternate AIMS supply)

3. OPEN RB sump return isolation valves

\_\_\_ CAV-436

\_\_\_ CAV-434

4. \_\_\_ Operations REPORTS valves OPEN

4.2.4 ALIGN CAT-8.

\_\_\_ SELECT CAP-10 control switch to AUTO

\_\_\_ START CAP-14

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

### NOTE

Relief valves CAV-702, CAV-705, and CAV-491 discharge to the MWST. Flow downstream of these valves is indicated at CA-50-FS located on count room mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

#### 4.2.5 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ DEPRESS CA-74-FI RESET button to zero flow totalizer. REFER to Enclosure 6.
3. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

#### 4.2.6 ALIGN flow to high and low range hydrogen analyzers.

1. POSITION the following valves
  - a. \_\_\_ CAV-627 SAMPLE
  - b. \_\_\_ CAV-628 SAMPLE HYDROGEN
  - c. \_\_\_ CAV-629 SAMPLE
  - d. \_\_\_ CAV-630 SAMPLE
  - e. \_\_\_ CAV-633 PH/IC ANAL
  - f. \_\_\_ CAV-634 SAMPLE
2. \_\_\_ START CAP-13. Normal pressure at CA-76-PI is approximately 28 in-Hg.
3. \_\_\_ DEPRESS CA-78-FI RESET button to zero flow totalizer. REFER to Enclosure 6.

**CAUTION**

Exceeding 100 psig at CA-77-PI may cause relief valve CAV-669 to open.

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

4.2.7 ADJUST system flows. CAV-631 and CAV-484 may require multiple adjustments to balance flows between the different flow paths.

\_\_\_ THROTTLE CAV-631 to obtain approximately 0.067 gpm at CA-78-FI. DO NOT exceed 100 psig at CA-77-PI.

\_\_\_ ADJUST CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.

4.2.8 DETERMINE status of RC letdown flow from Operations.

[ ] RC letdown flow secured

OR

[ ] RC letdown flow lined up

**NOTE**

Procedure may continue while flushing sample.

4.2.9 FLUSH sample lines.

CAV-126 open (RC Letdown secured) – FLUSH at least 45 gallons

OR

CAV-126 open (RC letdown lined up) – FLUSH at least 17.5 gallons

OR

CAV-429 open (RCP-1A discharge) – FLUSH at least 3 gallons

OR

CAV-430 open (RCP-1C suction) – FLUSH at least 3 gallons

4.2.10 ENSURE the following temperatures are maintained. REFER to Enclosure 2.

\_\_\_ CA-54 TE-1 RCS < 120 °F

\_\_\_ CA-51 TE WATER < 100 °F

4.2.11 IF gamma isotopic analysis is to be performed,  
THEN ENSURE PASS AIMS detector CA-54-CE ready for use.

\_\_\_ REFER to Enclosure 3 for guidance

Liquid nitrogen dewar > 50 pounds

Detector voltage adjusted

QC requirements met

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

**NOTE**

Enclosure 5 may be used to evaluate % core damage

**NOTE**

All analyses may be performed concurrently.

4.2.12

IF gamma isotopic analysis is to be performed,  
THEN PERFORM the following:

1.  VERIFY minimum sample flush complete.  
Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings.  
REFER to Enclosure 6:
2. REFER to Enclosure 4 for gamma isotopic analysis  
 SELECT applicable sample point  
 Reactor Coolant Letdown Sample  
OR  
 RCP-1A Discharge Sample  
OR  
 RCP-1C Suction Sample
3.  ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.2.13

IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings. REFER to Enclosure 6.
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

4.2.14

IF hydrogen analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings. REFER to Enclosure 6.
2. \_\_\_ ENSURE sample flushed through hydrogen analyzer at least 15 minutes
3. \_\_\_ OBTAIN hydrogen concentration at CA-55-CI. REFER to Enclosure 7.

Hydrogen concentration(s)

\_\_\_\_\_ cc/kg

\_\_\_\_\_ cc/kg

\_\_\_\_\_ cc/kg

4.2.15

IF pH analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings. REFER to Enclosure 6.
2. \_\_\_ ENSURE sample flushed through pH analyzer at least 15 minutes
3. \_\_\_ ENSURE pH meter display is NOT in HOLD mode. REFER to Enclosure 8.
4. \_\_\_ OBTAIN pH at CA-73-CI. REFER to Enclosure 8.

pH reading(s)

\_\_\_\_\_ pH

\_\_\_\_\_ pH

\_\_\_\_\_ pH

**CAUTION**

Exceeding 100 psig at CA-77-PI may cause relief valve CAV-669 to open.

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

4.2.16 ALIGN for demineralized water flush.

1. NOTIFY Operations to CLOSE containment isolation valves

a. CLOSE sample isolation valve

CAV-126 (Reactor Coolant Letdown)

OR

CAV-429 (RCP-1A Discharge)

OR

CAV-430 (RCP-1C Suction)

b. CLOSE PASS Containment isolation valve

CAV-431 (normal AIMS supply)

OR

CAV-432 (alternate AIMS supply)

c. \_\_\_ Operations REPORTS valves closed

2. OPEN the following demineralized water supply valves

\_\_\_ DWV-337

\_\_\_ CAV-470

3. ADJUST system flows. CAV-631 and CAV-484 may require multiple adjustments to balance flows between the different flow paths.

\_\_\_ THROTTLE CAV-631 to obtain approximately 0.067 gpm at CA-78-FI. DO NOT exceed 100 psig at CA-77-PI.

\_\_\_ ADJUST CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.

4.2.17 ENSURE adequate system purge.

1. \_\_\_ ENSURE logged onto PASS computer
2. \_\_\_ ENSURE PASS Menu selected
3. \_\_\_ SELECT Flush Sample Lines
4. \_\_\_ SELECT RCS Demin Flush
5. \_\_\_ FLUSH at least 10 minutes
6. \_\_\_ PRESS ENTER when flush is complete
7. \_\_\_ SELECT Quit to exit
8. \_\_\_ ENTER LO to log off PASS

4.2.18 SECURE line-up.

1. \_\_\_ STOP CAP-14
2. \_\_\_ SELECT CAP-10 control switch to OFF
3. \_\_\_ STOP CAP-13
4. CLOSE demineralized water isolation valves
  - \_\_\_ DWV-337
  - \_\_\_ CAV-470
5. CLOSE the following valves
  - \_\_\_ CAV-519
  - \_\_\_ CAV-447
  - \_\_\_ CAV-448
  - \_\_\_ CAV-484
  - \_\_\_ CAV-623
  - \_\_\_ CAV-625
  - \_\_\_ CAV-626
  - \_\_\_ CAV-627
  - \_\_\_ CAV-628
  - \_\_\_ CAV-629
  - \_\_\_ CAV-630
  - \_\_\_ CAV-631
  - \_\_\_ CAV-633
6. NOTIFY Operations to CLOSE the following valves
  - \_\_\_ CAV-436
  - \_\_\_ CAV-434

4.2.19 RESTORE normal configuration.

1. \_\_\_ OPEN CAV-439
2. \_\_\_ OPEN CAV-636
3. \_\_\_ SELECT CAP-10 control switch to AUTO

Section 4.2 Complete \_\_\_/\_\_\_  
Initial/Date

4.3 **Reactor Coolant Gamma Isotopic, Boron, Hydrogen, pH, or Chloride Analysis**

4.3.1 VERIFY radio communication.

\_\_\_ WHEN sample team exits OSC,  
THEN VERIFY radio communication with OSC Chemistry Coordinator or  
designee

4.3.2 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF
2. CLOSE the following valves
  - \_\_\_ CAV-439
  - \_\_\_ CAV-636
3. OPEN the following valves
  - \_\_\_ CAV-519
  - \_\_\_ CAV-447
  - \_\_\_ CAV-448
4. POSITION the following valves
  - \_\_\_ CAV-623 to SAMPLE
  - \_\_\_ CAV-625 to SAMPLE
  - \_\_\_ CAV-626 to DRAIN TANK

4.3.3 REQUEST Operations OPEN containment isolation valves.

1. OPEN sample isolation valve
  - CAV-126 (Reactor Coolant Letdown)
  - OR
  - CAV-429 (RCP-1A Discharge)
  - OR
  - CAV-430 (RCP-1C Suction)
2. OPEN PASS Containment isolation valve
  - CAV-431 (normal AIMS supply)
  - OR
  - CAV-432 (alternate AIMS supply)
3. OPEN RB sump return isolation valves
  - CAV-436
  - CAV-434
4.  Operations REPORTS valves OPEN

4.3.4 ALIGN CAT-8.

- SELECT CAP-10 control switch to AUTO
- START CAP-14

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

### NOTE

Relief valves CAV-702, CAV-705, and CAV-491 discharge to the MWST. Flow downstream of these valves is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

#### 4.3.5 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ DEPRESS CA-74-FI RESET button to zero flow totalizer. REFER to Enclosure 6.
3. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

#### 4.3.6 ALIGN flow to high and low range hydrogen analyzers.

1. POSITION the following valves
  - a. \_\_\_ CAV-627 SAMPLE
  - b. \_\_\_ CAV-628 SAMPLE HYDROGEN
  - c. \_\_\_ CAV-629 SAMPLE
  - d. \_\_\_ CAV-630 SAMPLE
  - e. \_\_\_ CAV-633 PH/IC ANAL
2. \_\_\_ START CAP-13. Normal pressure at CA-76-PI is approximately 28 in-Hg.
3. \_\_\_ DEPRESS CA-78-FI RESET button to zero flow totalizer. REFER to Enclosure 6.

**CAUTION**

Exceeding 100 psig at CA-77-PI may cause relief valve CAV-669 to open.

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

4.3.7 ADJUST system flows. CAV-631 and CAV-484 may require multiple adjustments to balance flows between the different flow paths.

\_\_\_ THROTTLE CAV-631 to obtain approximately 0.067 gpm at CA-78-FI. DO NOT exceed 100 psig at CA-77-PI.

\_\_\_ ADJUST CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.

4.3.8 DETERMINE status of RC letdown flow from Operations.

RC letdown flow secured

OR

RC letdown flow lined up

**NOTE**

Procedure may continue while flushing sample.

4.3.9

FLUSH sample lines.

CAV-126 open (RC Letdown secured) – FLUSH at least 45 gallons

OR

CAV-126 open (RC letdown lined up) – FLUSH at least 17.5 gallons

OR

CAV-429 open (RCP-1A discharge) – FLUSH at least 3 gallons

OR

CAV-430 open (RCP-1C suction) – FLUSH at least 3 gallons

4.3.10

ENSURE the following temperatures are maintained. REFER to Enclosure 2.

\_\_\_ CA-54 TE-1 RCS < 120 °F

\_\_\_ CA-51 TE WATER < 100 °F

4.3.11

IF gamma isotopic analysis is to be performed,  
THEN ENSURE PASS AIMS detector CA-54-CE ready for use.

\_\_\_ REFER to Enclosure 3 for guidance

Liquid nitrogen dewar > 50 pounds

Detector voltage adjusted

QC requirements met

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

**NOTE**

Enclosure 5 may be used to evaluate % core damage

**NOTE**

All analyses may be performed concurrently.

4.3.12

IF gamma isotopic analysis is to be performed,  
THEN PERFORM the following:

1.  VERIFY minimum sample flush complete.  
Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings.  
REFER to Enclosure 6.
2. REFER to Enclosure 4 for gamma isotopic analysis  
 SELECT applicable sample point  
 Reactor Coolant Letdown Sample  
OR  
 RCP-1A Discharge Sample  
OR  
 RCP-1C Suction Sample
3.  ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.3.13

IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings. REFER to Enclosure 6.
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

4.3.14

IF hydrogen analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings. REFER to Enclosure 6.
2. \_\_\_ ENSURE sample flushed through hydrogen analyzer at least 15 minutes
3. \_\_\_ OBTAIN hydrogen concentration at CA-55-CI. REFER to Enclosure 7.

Hydrogen concentration(s)

\_\_\_\_\_ cc/kg

\_\_\_\_\_ cc/kg

\_\_\_\_\_ cc/kg

4.3.15 IF pH analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer readings. REFER to Enclosure 6.
2. \_\_\_ ENSURE sample flushed through pH analyzer at least 15 minutes
3. \_\_\_ ENSURE pH meter is NOT in HOLD mode. REFER to Enclosure 8.
4. \_\_\_ OBTAIN pH at CA-73-CI. REFER to Enclosure 8.

pH reading(s)

\_\_\_\_\_ pH

\_\_\_\_\_ pH

\_\_\_\_\_ pH

4.3.16 IF chloride analysis is to be performed,  
THEN PERFORM the following:

1. START PASS Ion Chromatograph. REFER to Enclosure 9.
  - ENSURE ion chromatograph is calibrated
  - QC check requirements are met.
2. \_\_\_ VERIFY minimum sample flush complete. Flush volume is the sum of CA-74-FI and CA-78-FI totalizer reading. REFER to Enclosure 6.
3. \_\_\_ OPEN CAV-525
4. \_\_\_ ANALYZE RCS. REFER to Enclosure 9.
5. \_\_\_ ATTACH chromatograms to this procedure
6. \_\_\_ WHEN analyses are complete  
THEN ENSURE the following:
  - SYS 2 B valve selected to OFF (RCS lined up)
  - SYS 2 LOAD/INJECT valve selected to LOAD

Chloride concentration(s)

\_\_\_\_\_ ppb

\_\_\_\_\_ ppb

\_\_\_\_\_ ppb

**CAUTION**

Exceeding 100 psig at CA-77-PI may cause relief valve CAV-669 to open.

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

4.3.17

ALIGN for demineralized water flush.

1. NOTIFY Operations to CLOSE containment isolation valves

a. CLOSE sample isolation valve

CAV-126 (Reactor Coolant Letdown)

OR

CAV-429 (RCP-1A Discharge)

OR

CAV-430 (RCP-1C Suction)

b. CLOSE PASS Containment isolation valve

CAV-431 (normal AIMS supply)

OR

CAV-432 (alternate AIMS supply)

c. \_\_\_ Operations REPORTS valves closed

2. OPEN the following demineralized water supply valves

\_\_\_ DWV-337

\_\_\_ CAV-470

3. ADJUST system flows. CAV-631 and CAV-484 may require multiple adjustments to balance flows between the different flow paths.

\_\_\_ THROTTLE CAV-631 to obtain approximately 0.067 gpm at CA-78-FI. DO NOT exceed 100 psig at CA-77-PI.

\_\_\_ ADJUST CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.

4.3.18 ENSURE adequate system purge.

1. \_\_\_ ENSURE logged onto PASS computer
2. \_\_\_ ENSURE PASS Menu selected
3. \_\_\_ SELECT Flush Sample Lines
4. \_\_\_ SELECT RCS Demin Flush
5. \_\_\_ FLUSH at least 10 minutes
6. \_\_\_ PRESS ENTER when flush is complete
7. \_\_\_ SELECT Quit to exit
8. \_\_\_ ENTER LO to log off PASS

4.3.19 FLUSH ion chromatograph.

1. \_\_\_ OPEN analytical pump inlet manifold reagent grade water supply valve
2. \_\_\_ CLOSE analytical pump inlet manifold eluent supply valve
3. \_\_\_ SELECT SYS 2 B valve to B ON
4. \_\_\_ ENSURE SYS 2 LOAD/INJECT valve selected to LOAD
5. \_\_\_ FLUSH at least 30 minutes

4.3.20 SHUT DOWN ion chromatograph. REFER to Enclosure 9.

4.3.21 SECURE line-up.

1.  STOP CAP-14
2.  SELECT CAP-10 control switch to OFF
3.  STOP CAP-13
4. CLOSE demineralized water isolation valves
  - DWV-337
  - CAV-470
5. CLOSE the following valves
  - CAV-519
  - CAV-447
  - CAV-448
  - CAV-484
  - CAV-623
  - CAV-625
  - CAV-626
  - CAV-627
  - CAV-628
  - CAV-629
  - CAV-630
  - CAV-631
  - CAV-633
  - CAV-634
  - CAV-525
6. NOTIFY Operations to CLOSE the following valves
  - CAV-436
  - CAV-434

4.3.22 RESTORE normal configuration.

1.  OPEN CAV-439
2.  OPEN CAV-636
3.  SELECT CAP-10 control switch to AUTO

Section 4.3 complete Initial/Date \_\_\_\_\_/\_\_\_\_\_

4.4 Reactor Coolant Gamma Isotopic, Boron, or Grab Sample Via CASB-5 Liquid Grab Sampler

- 4.4.1 WHEN sample team exits OSC.  
THEN VERIFY radio communications with OSC Chemistry Coordinator or designee.

**NOTE**

CASB-5 exhaust fan (AHF-55) switch is located to the right of Intermediate Building door (across from RM-A7)

- 4.4.2 ESTABLISH ventilation for liquid grab sampling.

\_\_\_ POSITION AHF-55 switch to ON

- 4.4.3 ENSURE liquid grab sampler, CASB-5, installed.

Liquid grab sampler already installed

OR

REFER to Enclosure 10 for liquid grab sampler installation instructions

- 4.4.4 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF

2. CLOSE the following valves

\_\_\_ CAV-439

\_\_\_ CAV-636

3. OPEN the following valves

\_\_\_ CAV-519

\_\_\_ CAV-447

\_\_\_ CAV-448

4. POSITION the following valves

\_\_\_ CAV-623 to SAMPLE

\_\_\_ CAV-625 to SAMPLE

\_\_\_ CAV-626 to DRAIN TANK

4.4.5 REQUEST Operations OPEN containment isolation valves.

1. OPEN sample isolation valve  
 CAV-126 (Reactor Coolant Letdown)

OR

- CAV-429 (RCP-1A Discharge)

OR

- CAV-430 (RCP-1C Suction)

2. OPEN PASS Containment isolation valve

- CAV-431 (normal AIMS supply)

OR

- CAV-432 (alternate AIMS supply)

3. OPEN RB sump return isolation valves

CAV-436

CAV-434

4.  Operations REPORTS valves OPEN

4.4.6 ALIGN CAT-8.

SELECT CAP-10 control switch to AUTO

START CAP-14

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valves CAV-702 or CAV-491 to open. Flow from these valves is routed to the MWST, which could cause radiation levels to increase in the AB.

### NOTE

Relief valves CAV-702, CAV-705, and CAV-491 discharge to the MWST. Flow downstream of these valves is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

#### 4.4.7 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ DEPRESS CA-74-FI RESET button to zero flow totalizer. REFER to Enclosure 6.
3. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

#### 4.4.8 DETERMINE status of RC letdown flow from Operations.

RC letdown flow secured

OR

RC letdown flow lined up

**NOTE**

Procedure may continue while flushing sample.

4.4.9 FLUSH sample lines. Total flush volume is indicated using CA-74-FI totalizer reading. REFER to Enclosure 6.

CAV-126 open (RC Letdown secured) – FLUSH at least 45 gallons

OR

CAV-126 open (RC letdown lined up) – FLUSH at least 17.5 gallons

OR

CAV-429 open (RCP-1A discharge) – FLUSH at least 3 gallons

OR

CAV-430 open (RCP-1C suction) – FLUSH at least 3 gallons

4.4.10 ENSURE the following temperatures are maintained. REFER to Enclosure 2.

\_\_\_ CA-54 TE-1 RCS < 120 °F

\_\_\_ CA-51 TE WATER < 100 °F

4.4.11 ENSURE PASS AIMS detector CA-54-CE ready for use.

\_\_\_ REFER to Enclosure 3 for guidance

Liquid nitrogen dewar > 50 pounds

Detector voltage adjusted

QC requirements met

**NOTE**

Gamma isotopic analysis may be performed concurrently with liquid grab sampler flush.

4.4.12      **ALIGN** system for liquid grab sample

1. \_\_\_ ENSURE minimum sample flush complete. Total flush volume is indicated using CA-74-FI totalizer reading
2. \_\_\_ OPEN CAV-445
3. \_\_\_ OPEN CAV-446
4. \_\_\_ CLOSE CAV-447
5. \_\_\_ FLUSH at least 15 minutes.

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

4.4.13      **PERFORM** gamma isotopic analysis.

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ REFER to Enclosure 4 for gamma isotopic analysis  
   \_\_\_ SELECT applicable sample point  
  
   [ ] Reactor Coolant Letdown Sample  
  
   OR  
  
   [ ] RCP-1A Discharge Sample  
  
   OR  
  
   [ ] RCP-1C Suction Sample
3. \_\_\_ ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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- 4.4.14 ISOLATE grab sample.
1. \_\_\_ CLOSE CAV-492
  2. \_\_\_ CLOSE CAV-493

\_\_\_\_\_  
Grab sample Date/Time

- 4.4.15 ALIGN for demineralized water flush.
1. NOTIFY Operations to CLOSE containment isolation valves
    - a. CLOSE sample isolation valve
      - CAV-126 (Reactor Coolant Letdown)
      - OR
      - CAV-429 (RCP-1A Discharge)
      - OR
      - CAV-430 (RCP-1C Suction)
    - b. CLOSE PASS Containment isolation valve
      - CAV-431 (normal AIMS supply)
      - OR
      - CAV-432 (alternate AIMS supply)
    - c. \_\_\_ Operations REPORTS valves closed
  2. OPEN the following demineralized water supply valves
    - \_\_\_ DWV-337
    - \_\_\_ CAV-470
  3. ADJUST system flows. CAV-484 may require multiple adjustments to balance flows between the different flow paths.
    - \_\_\_ ADJUST CAV-484 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.

- 4.4.16 ENSURE adequate system purge.
1. \_\_\_ ENSURE logged onto PASS computer
  2. \_\_\_ ENSURE PASS Menu selected
  3. \_\_\_ SELECT Flush Sample Lines
  4. \_\_\_ SELECT RCS Demin Flush
  5. \_\_\_ FLUSH at least 10 minutes
  6. \_\_\_ PRESS ENTER when flush is complete
  7. \_\_\_ SELECT Quit to exit
  8. \_\_\_ ENTER LO to log off PASS

- 4.4.17 RESTORE system line-up.
1. \_\_\_ OPEN CAV-447
  2. \_\_\_ CLOSE CAV-445
  3. \_\_\_ CLOSE CAV-446
  4. \_\_\_ FLUSH at least 1 minute
  5. \_\_\_ STOP CAP-14
  6. \_\_\_ SELECT CAP-10 control switch to OFF
  7. CLOSE demineralized water isolation valves
    - \_\_\_ DWV-337
    - \_\_\_ CAV-470
  8. CLOSE the following valves
    - \_\_\_ CAV-519
    - \_\_\_ CAV-447
    - \_\_\_ CAV-448
    - \_\_\_ CAV-484
    - \_\_\_ CAV-623
    - \_\_\_ CAV-625
    - \_\_\_ CAV-626
  9. NOTIFY Operations to CLOSE the following valves
    - \_\_\_ CAV-436
    - \_\_\_ CAV-434

- 4.4.18 RESTORE normal configuration.
1. \_\_\_ OPEN CAV-439
  2. \_\_\_ OPEN CAV-636
  3. \_\_\_ SELECT CAP-10 control switch to AUTO

4.4.19 REMOVE Liquid Grab Sampler, CASB-5.

1. \_\_\_ REMOVE liquid grab sampler from sample station, REFER to Enclosure 10
2. \_\_\_ TRANSPORT liquid grab sampler to 95' TB Crane Well
3. \_\_\_ UNBOLT liquid grab sampler from cart using 3/4" wrench or equivalent as determined by Chemistry Technician
4. \_\_\_ INSTALL transit cover over quick connects
5. \_\_\_ MEASURE dose rates from liquid grab sampler

Contact dose rate (side of pig) \_\_\_\_\_ mR/hr

Dose rate @ 3 feet \_\_\_\_\_ mR/hr

4.4.20 PREPARE for liquid grab sample shipment.

\_\_\_ REFER to Enclosure 11 for off-site shipment and notifications

Section 4.4 complete Initial/Date \_\_\_\_\_/\_\_\_\_\_

4.5 Decay Heat System Gamma Isotopic or Boron Analysis

4.5.1 VERIFY radio communication.

\_\_\_ WHEN sample team exits OSC,  
\_\_\_ THEN VERIFY radio communication with OSC Chemistry Coordinator or designee

4.5.2 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF
2. \_\_\_ CLOSE the following valves
  - \_\_\_ CAV-439
  - \_\_\_ CAV-636
3. \_\_\_ OPEN the following valves
  - \_\_\_ CAV-519
  - \_\_\_ CAV-447
  - \_\_\_ CAV-448
4. \_\_\_ POSITION the following valves
  - \_\_\_ CAV-623 to SAMPLE
  - \_\_\_ CAV-625 to SAMPLE
  - \_\_\_ CAV-626 to DRAIN TANK

4.5.3 REQUEST Operations OPEN containment isolation valves:

1. OPEN RB sump return isolation valves

\_\_\_ CAV-436

\_\_\_ CAV-434

2. \_\_\_ Operations REPORTS valves OPEN

4.5.4 ALIGN CAT-8.

\_\_\_ SELECT CAP-10 control switch to AUTO

\_\_\_ START CAP-14

4.5.5 ENSURE CAV-701 positioned to PORT 2. This determination was made during the pre-job briefing. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located MIDDLE LEFT inside CAX-1 approximately head high.

4.5.6 OPEN DH system sample isolation valves.

[ ] Decay Heat Train "A"

\_\_\_ CAV-441

\_\_\_ CAV-440

OR

[ ] Decay Heat Train "B"

\_\_\_ CAV-442

\_\_\_ CAV-440

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

**NOTE**

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

4.5.7 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

**NOTE**

Procedure may continue while flushing sample.

4.5.8 FLUSH sample lines.

\_\_\_ FLUSH at least 5 minutes

4.5.9 IF gamma isotopic analysis is to be performed,  
THEN ENSURE PASS AIMS detector CA-54-CE ready for use.

- \_\_\_ REFER to Enclosure 3 for guidance
- Liquid nitrogen dewar > 50 pounds
  - Detector voltage adjusted
  - QC requirements met

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

**NOTE**

Enclosure 5 may be used to evaluate % core damage

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently.

4.5.10

IF gamma isotopic analysis is to be performed,  
THEN PERFORM the following:

1.  VERIFY minimum sample flush complete
2.  REFER to Enclosure 4 for gamma isotopic analysis  
 SELECT applicable sample point  
 A-Decay Heat Train Sample  
OR  
 B-Decay Heat Train Sample
3.  ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.5.11

IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

4.5.12 ALIGN for demineralized water flush.

1. CLOSE the following valves

Decay Heat Train "A"

\_\_\_ CAV-441

\_\_\_ CAV-440

OR

Decay Heat Train "B"

\_\_\_ CAV-442

\_\_\_ CAV-440

2. OPEN the following demineralized water supply valves

\_\_\_ DWV-337

\_\_\_ CAV-471

3. \_\_\_ START CAP-8

4. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI

4.5.13 ENSURE adequate system purge.

1. \_\_\_ ENSURE logged onto PASS computer
2. \_\_\_ ENSURE PASS Menu selected
3. \_\_\_ SELECT Flush Sample Lines
4. \_\_\_ SELECT Sump Demin Flush
5. \_\_\_ FLUSH at least 10 minutes
6. \_\_\_ PRESS ENTER when flush is complete
7. \_\_\_ SELECT Quit to exit
8. \_\_\_ ENTER LO to log off PASS

4.5.14 SECURE line-up.

1. \_\_\_ STOP CAP-8
2. \_\_\_ STOP CAP-14
3. \_\_\_ SELECT CAP-10 control switch to OFF
4. CLOSE demineralized water isolation valves
  - \_\_\_ DWV-337
  - \_\_\_ CAV-471
5. CLOSE the following valves
  - \_\_\_ CAV-519
  - \_\_\_ CAV-447
  - \_\_\_ CAV-448
  - \_\_\_ CAV-623
  - \_\_\_ CAV-624
  - \_\_\_ CAV-625
  - \_\_\_ CAV-626
6. NOTIFY Operations to CLOSE the following valves
  - \_\_\_ CAV-436
  - \_\_\_ CAV-434

4.5.15 RESTORE normal configuration.

1. \_\_\_ OPEN CAV-439
2. \_\_\_ OPEN CAV-636
3. \_\_\_ SELECT CAP-10 control switch to AUTO

Section 4.5 complete           /            
Initial/Date

4.6 **RB Sump Gamma Isotopic and Boron Analysis**

4.6.1 **VERIFY radio communication.**

— WHEN sample team exits OSC,  
THEN VERIFY radio communication with OSC Chemistry Coordinator or designee

4.6.2 **ALIGN system for sample.**

1. — SELECT CAP-10 control switch to OFF

2. POSITION the following valves

NORMAL RB Sump sample

— OPEN CAV-448

— CLOSE CAV-439

— CLOSE CAV-636

OR

ALTERNATE RB Sump sample

— CLOSE CAV-636

3. OPEN the following valves

— OPEN CAV-519

— OPEN CAV-447

4. POSITION the following valves

— CAV-623 to SAMPLE

— CAV-625 to SAMPLE

— CAV-626 to DRAIN TANK

**CAUTION**

When sampling RB Sump ALTERNATE sample point, sample is pumped to the MWST which could result in increased radiation levels in the AB.

**NOTE**

Operating CAV-500 requires an entry to 95' IB

4.6.3 OPEN sample valves.

NORMAL RB Sump sample

1. REQUEST Operations OPEN containment isolation valves

\_\_\_ CAV-434

\_\_\_ CAV-436

2. \_\_\_ Operations REPORTS valves OPEN

OR

ALTERNATE RB Sump sample

\_\_\_ OPEN CAV-500 (located inside 95' IB approximately 3' past OTSG sample valve manifold approximately 7' above floor)

4.6.4 ALIGN CAT-8.

\_\_\_ SELECT CAP-10 control switch to AUTO

\_\_\_ START CAP-14

4.6.5 ENSURE CAV-701 positioned to PORT 2. This determination was made during the pre-job briefing. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located MIDDLE LEFT inside CAX-1 approximately head high.

4.6.6 PRIME CAP-8

1. OPEN demineralized water supply valves  
\_\_\_ DWV-337  
\_\_\_ CAV-471
2. \_\_\_ START CAP-8
3. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35–0.50 gpm on CA-74-FI.

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

**NOTE**

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

4.6.7 REQUEST Operations OPEN containment isolation valves.

1. OPEN sample isolation valves:  
[ ] NORMAL RB Sump sample  
\_\_\_ CAV-433  
\_\_\_ CAV-435  
  
OR  
[ ] ALTERNATE RB Sump sample  
\_\_\_ CAV-434  
\_\_\_ CAV-436
2. \_\_\_ Operations REPORTS valves OPEN
3. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35–0.50 gpm on CA-74-FI.

4.6.8 WHEN stable flow indicated at CA-74-FI,  
THEN CLOSE CAP-8 priming water valves.

- \_\_\_ DWV-337  
\_\_\_ CAV-471

**CAUTION**

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

**NOTE**

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

4.6.9 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

**NOTE**

Procedure may continue while flushing sample.

4.6.10 FLUSH sample lines.

\_\_\_ FLUSH at least 35 minutes

4.6.11 IF gamma isotopic analysis is to be performed,  
THEN ENSURE PASS AIMS detector CA-54-CE ready for use.

\_\_\_ REFER to Enclosure 3 for guidance

- Liquid nitrogen dewar > 50 pounds
- Detector voltage adjusted
- QC requirements met

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

**NOTE**

Enclosure 5 may be used to evaluate % core damage

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently.

4.6.12 IF gamma isotopic analysis is to be performed,  
THEN PERFORM the following:

1.  VERIFY minimum sample flush complete
2. REFER to Enclosure 4 for gamma isotopic analysis  
 SELECT Reactor Building Sump Sample
3.  ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.6.13

IF boron analysis is to be performed,  
THEN **PERFORM** the following:

1. \_\_\_ **VERIFY** minimum sample flush complete
2. \_\_\_ **ENSURE** sample flushed through boronometer at least 2 hours
3. \_\_\_ **OBSERVE** boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

## CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

### 4.6.14 ALIGN for demineralized water flush.

1. OPEN demineralized water supply valves
  - DWV-337
  - CAV-471
2. REQUEST Operations CLOSE sample isolation valves
  - NORMAL RB Sump sample
    - CAV-433
    - CAV-435

OR

- ALTERNATE RB Sump sample
  - CAV-434
  - CAV-436
3.  Operations REPORTS valves CLOSED
4.  THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI

### 4.6.15 ENSURE adequate system purge.

1.  ENSURE logged onto PASS computer
2.  ENSURE PASS Menu selected
3.  SELECT Flush Sample Lines
4.  SELECT Sump Demin Flush
5.  FLUSH at least 10 minutes
6.  PRESS ENTER when flush is complete
7.  SELECT Quit to exit
8.  ENTER LO to log off PASS

**NOTE**

Operating CAV-500 requires an entry to 95' IB

4.6.16

SECURE line-up.

1.  STOP CAP-8
2.  STOP CAP-14
3.  SELECT CAP-10 control switch to OFF
4. CLOSE demineralized water isolation valves
  - DWV-337
  - CAV-471
5. ENSURE CLOSED the following valves
  - CAV-519
  - CAV-447
  - CAV-448
  - CAV-623
  - CAV-624
  - CAV-625
  - CAV-626
6. NOTIFY Operations to ENSURE CLOSED the following valves
  - CAV-436
  - CAV-434
7.  IF ALTERNATE RB Sump sample was obtained,  
THEN CLOSE CAV-500 (located inside 95' IB approximately 3' past OTSG  
sample valve manifold approximately 7' above floor)

4.6.17

RESTORE normal configuration.

1.  ENSURE OPEN CAV-439
2.  OPEN CAV-636
3.  SELECT CAP-10 control switch to AUTO

\_\_\_\_\_/\_\_\_\_\_  
Initial/Date

4.7 Miscellaneous Waste Storage Tank Gamma Isotopic and Boron Analysis

4.7.1 VERIFY radio communication.

\_\_\_ WHEN sample team exits OSC,  
\_\_\_ THEN VERIFY radio communication with OSC Chemistry Coordinator or designee

4.7.2 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF
2. \_\_\_ CLOSE the following valves  
\_\_\_ CAV-439  
\_\_\_ CAV-636
3. \_\_\_ OPEN the following valves  
\_\_\_ CAV-519  
\_\_\_ CAV-447  
\_\_\_ CAV-448
4. \_\_\_ POSITION the following valves  
\_\_\_ CAV-623 to SAMPLE  
\_\_\_ CAV-625 to SAMPLE  
\_\_\_ CAV-626 to DRAIN TANK

4.7.3 REQUEST Operations OPEN containment isolation valves.

1. \_\_\_ OPEN RB sump return isolation valves  
\_\_\_ CAV-436  
\_\_\_ CAV-434
2. \_\_\_ Operations REPORTS valves OPEN

4.7.4 ALIGN CAT-8.

\_\_\_ SELECT CAP-10 control switch to AUTO  
\_\_\_ START CAP-14

4.7.5 ENSURE CAV-701 positioned to PORT 2. This determination was made during the pre-job briefing. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located MIDDLE LEFT inside CAX-1 approximately head high.

4.7.6 OPEN MWST sample isolation valves.

- \_\_\_ CAV-443
- \_\_\_ CAV-444

**NOTE**

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

4.7.7 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI
2. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

**NOTE**

Procedure may continue while flushing sample.

4.7.8 FLUSH sample lines.

- \_\_\_ FLUSH at least 5 minutes

4.7.9 IF gamma isotopic analysis is to be performed,  
THEN ENSURE PASS AIMS detector CA-54-CE ready for use.

- \_\_\_ REFER to Enclosure 3 for guidance
  - [ ] Liquid nitrogen dewar > 50 pounds
  - [ ] Detector voltage adjusted
  - [ ] QC requirements met

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently.

4.7.10 IF gamma isotopic analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. REFER to Enclosure 4 for gamma isotopic analysis  
\_\_\_ SELECT Miscellaneous Waste Storage Tank Sample
3. \_\_\_ ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.7.11 IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

4.7.12 ALIGN for demineralized water flush.

1. CLOSE sample isolation valves
  - \_\_\_ CAV-443
  - \_\_\_ CAV-444
2. OPEN the following demineralized water supply valves
  - \_\_\_ DWV-337
  - \_\_\_ CAV-471
3. \_\_\_ START CAP-8
4. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI

4.7.13 ENSURE adequate system purge.

1.  ENSURE logged onto PASS computer
2.  ENSURE PASS Menu selected
3.  SELECT Flush Sample Lines
4.  SELECT Sump Demin Flush
5.  FLUSH at least 10 minutes
6.  PRESS ENTER when flush is complete
7.  SELECT Quit to exit
8.  ENTER LO to log off PASS

4.7.14 SECURE line-up.

1.  STOP CAP-8
2.  STOP CAP-14
3.  SELECT CAP-10 control switch to OFF
4. CLOSE demineralized water isolation valves
  - DWV-337
  - CAV-471
5. CLOSE the following valves
  - CAV-519
  - CAV-447
  - CAV-448
  - CAV-623
  - CAV-624
  - CAV-625
  - CAV-626
6. NOTIFY Operations to CLOSE the following valves
  - CAV-436
  - CAV-434

4.7.15 RESTORE normal configuration.

1.  OPEN CAV-439
2.  OPEN CAV-636
3.  SELECT CAP-10 control switch to AUTO

Section 4.7 complete Initial/Date \_\_\_\_\_/\_\_\_\_\_

4.8 Decay Heat Gamma Isotopic, Boron, or Grab Sample Via CASB-5 Liquid Grab Sampler

4.8.1 WHEN sample team exits OSC.  
THEN VERIFY radio communications with OSC Chemistry Coordinator or designee.

**NOTE**

CASB-5 exhaust fan (AHF-55) switch is located to the right of Intermediate Building door (across from RM-A7)

4.8.2 ESTABLISH ventilation for liquid grab sampling.

\_\_\_ POSITION AHF-55 switch to ON

4.8.3 ENSURE liquid grab sampler, CASB-5, installed.

[ ] Liquid grab sampler already installed

OR

[ ] REFER to Enclosure 10 for liquid grab sampler installation instructions

4.8.4 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF

2. CLOSE the following valves

\_\_\_ CAV-439

\_\_\_ CAV-636

3. OPEN the following valves

\_\_\_ CAV-519

\_\_\_ CAV-447

\_\_\_ CAV-448

4. POSITION the following valves

\_\_\_ CAV-623 to SAMPLE

\_\_\_ CAV-625 to SAMPLE

\_\_\_ CAV-626 to DRAIN TANK

4.8.5 REQUEST Operations OPEN containment isolation valves.

1. OPEN RB Sump return isolation valves
  - \_\_\_ CAV-436
  - \_\_\_ CAV-434
2. \_\_\_ Operations REPORTS valves OPEN

4.8.6 ALIGN CAT-8.

- \_\_\_ SELECT CAP-10 control switch to AUTO
- \_\_\_ START CAP-14

4.8.7 ENSURE CAV-701 positioned to PORT 2. This determination was made during the pre-job briefing. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located, MIDDLE LEFT inside CAX-1 approximately head high.

4.8.8 OPEN DH system sample isolation valves.

- Decay Heat Train "A"
  - \_\_\_ CAV-441
  - \_\_\_ CAV-440

OR

- Decay Heat Train "B"
  - \_\_\_ CAV-442
  - \_\_\_ CAV-440

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

### NOTE

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

4.8.9 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm on CA-74-FI. DO NOT exceed 175 psig at CA-89-PI
2. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

4.8.10 FLUSH sample lines.

\_\_\_ FLUSH for at least 5 minutes.

4.8.11 ENSURE PASS AIMS detector CA-54-CE ready for use.

- \_\_\_ REFER to Enclosure 3 for guidance
- [ ] Liquid nitrogen dewar > 50 pounds
  - [ ] Detector voltage adjusted
  - [ ] QC requirements met

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently with liquid grab sampler flush.

4.8.12      **ALIGN** system for liquid grab sample

1. \_\_\_ ENSURE minimum sample flush complete
2. \_\_\_ OPEN CAV-445
3. \_\_\_ OPEN CAV-446
4. \_\_\_ CLOSE CAV-447
5. \_\_\_ FLUSH at least 15 minutes.

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

4.8.13      **PERFORM** gamma isotopic analysis.

1. \_\_\_ VERIFY minimum sample flush complete
2. REFER to Enclosure 4 for gamma isotopic analysis  
\_\_\_ SELECT applicable sample point  
     A-Decay Heat Train Sample  
    OR  
     B-Decay Heat Train Sample
3. \_\_\_ ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

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4.8.14 ISOLATE grab sample.

1. \_\_\_ CLOSE CAV-492
2. \_\_\_ CLOSE CAV-493

\_\_\_\_\_  
Grab sample Date/Time

**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.8.15 IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

## CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

### 4.8.16 ALIGN for demineralized water flush.

1. CLOSE sample isolation valves.

Decay Heat Train "A"

\_\_\_ CAV-441

\_\_\_ CAV-440

OR

Decay Heat Train "B"

\_\_\_ CAV-442

\_\_\_ CAV-440

2. OPEN the following demineralized water supply valves

\_\_\_ DWV-337

\_\_\_ CAV-471

3. \_\_\_ START CAP-8

4. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm on CA-74-FI

### 4.8.17 ENSURE adequate system purge.

1. \_\_\_ ENSURE logged onto PASS computer

2. \_\_\_ ENSURE PASS Menu selected

3. \_\_\_ SELECT Flush Sample Lines

4. \_\_\_ SELECT Sump Demin Flush

5. \_\_\_ FLUSH at least 10 minutes

6. \_\_\_ PRESS ENTER when flush is complete

7. \_\_\_ SELECT Quit to exit

8. \_\_\_ ENTER LO to log off PASS

4.8.18

SECURE line-up.

1.  OPEN CAV-447
2.  CLOSE CAV-445
3.  CLOSE CAV-446
4.  FLUSH at least 1 minute
5.  STOP CAP-8
6.  STOP CAP-14
7.  SELECT CAP-10 control switch to OFF
  
8. CLOSE demineralized water isolation valves
  - DWV-337
  - CAV-471
  
9. CLOSE the following valves
  - CAV-519
  - CAV-447
  - CAV-448
  - CAV-623
  - CAV-624
  - CAV-625
  - CAV-626
  
10. NOTIFY Operations to CLOSE the following valves
  - CAV-436
  - CAV-434

4.8.19

RESTORE normal configuration.

1.  ENSURE OPEN CAV-439
2.  OPEN CAV-636
3.  SELECT CAP-10 control switch to AUTO

4.8.20 REMOVE Liquid Grab Sampler, CASB-5.

1. \_\_\_ REMOVE liquid grab sampler from sample station, REFER to Enclosure 10
2. \_\_\_ TRANSPORT liquid grab sampler to 95' TB Crane Well
3. \_\_\_ UNBOLT liquid grab sampler from cart using 3/4" wrench or equivalent as determined by Chemistry Technician
4. \_\_\_ INSTALL transit cover over quick connects
5. \_\_\_ MEASURE dose rates from liquid grab sampler

Contact dose rate (side of pig) \_\_\_\_\_ mR/hr

Dose rate @ 3 feet \_\_\_\_\_ mR/hr

4.8.21 PREPARE for liquid grab sample shipment.

\_\_\_ REFER to Enclosure 11 for off-site shipment and notifications

Section 4.8 complete       /        
Initial/Date

4.9 RB Sump Gamma Isotopic, Boron, or Grab Sample Via CASB-5 Liquid Grab Sampler

- 4.9.1 WHEN sample team exits OSC.  
THEN VERIFY radio communications with OSC Chemistry Coordinator or designee.

**NOTE**

CASB-5 exhaust fan (AHF-55) switch is located to the right of Intermediate Building door (across from RM-A7)

4.9.2 ESTABLISH ventilation for liquid grab sampling.

\_\_\_ POSITION AHF-55 switch to ON

4.9.3 ENSURE liquid grab sampler, CASB-5, installed.

[ ] Liquid grab sampler already installed

OR

[ ] REFER to Enclosure 10 for liquid grab sampler installation instructions

4.9.4 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF

2. POSITION the following valves

[ ] NORMAL RB Sump sample

\_\_\_ OPEN CAV-448

\_\_\_ CLOSE CAV-439

\_\_\_ CLOSE CAV-636

OR

[ ] ALTERNATE RB Sump sample

\_\_\_ CLOSE CAV-636

3. OPEN the following valves

\_\_\_ OPEN CAV-519

\_\_\_ OPEN CAV-447

4. POSITION the following valves

\_\_\_ CAV-623 to SAMPLE

\_\_\_ CAV-625 to SAMPLE

\_\_\_ CAV-626 to DRAIN TANK

### CAUTION

When sampling RB Sump ALTERNATE sample point, sample is pumped to the MWST which could result in increased radiation levels in the AB.

### NOTE

Operating CAV-500 requires an entry to 95' IB

4.9.5 OPEN sample valves.

- NORMAL RB Sump sample
1. REQUEST Operations OPEN containment isolation valves
    - \_\_\_ CAV-434
    - \_\_\_ CAV-436
  2. \_\_\_ Operations REPORTS valves OPEN

OR

- ALTERNATE RB Sump sample
- \_\_\_ OPEN CAV-500 (located inside 95' IB approximately 3' past OTSG sample valve manifold approximately 7' above floor)

4.9.6 ALIGN CAT-8.

- \_\_\_ SELECT CAP-10 control switch to AUTO
- \_\_\_ START CAP-14

4.9.7 ENSURE CAV-701 positioned to PORT 2. This determination was made during the pre-job briefing. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located MIDDLE LEFT inside CAX-1 approximately head high.

4.9.8

PRIME CAP-8

1. OPEN demineralized water supply valves:
  - DWV-337
  - CAV-471
2.  START CAP-8
3.  THROTTLE CAV-624 to MAINTAIN 0.35–0.50 gpm on CA-74-FI.

<b>CAUTION</b>
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<p>Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.</p>
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<b>NOTE</b>
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<p>Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.</p>
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4.9.9

REQUEST Operations OPEN containment isolation valves.

1. OPEN sample isolation valves:
  - NORMAL RB Sump sample
    - CAV-433
    - CAV-435
  - OR
  - ALTERNATE RB Sump sample
    - CAV-434
    - CAV-436
2.  Operations REPORTS valves OPEN
3.  THROTTLE CAV-624 to MAINTAIN 0.35–0.50 gpm on CA-74-FI.

4.9.10

WHEN stable flow indicated at CA-74-FI,  
THEN CLOSE CAP-8 priming water valves.

- DWV-337
- CAV-471

### CAUTION

Exceeding 175 psig on CA-89-PI may cause relief valve CAV-491 to open. Flow from this valve is routed to the MWST, which could cause radiation levels to increase in the AB.

### NOTE

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

#### 4.9.11 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm at CA-74-FI. DO NOT exceed 175 psig at CA-89-PI.
2. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

### NOTE

Procedure may continue while flushing sample.

#### 4.9.12 FLUSH sample lines.

- \_\_\_ FLUSH at least 35 minutes

#### 4.9.13 ENSURE PASS AIMS detector CA-54-CE ready for use.

- \_\_\_ REFER to Enclosure 3 for guidance
  - [ ] Liquid nitrogen dewar > 50 pounds
  - [ ] Detector voltage adjusted
  - [ ] QC requirements met

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently with liquid grab sampler flush.

- 4.9.14      ALIGN system for liquid grab sample
1.    \_\_\_ ENSURE minimum sample flush complete
  2.    \_\_\_ OPEN CAV-445
  3.    \_\_\_ OPEN CAV-446
  4.    \_\_\_ CLOSE CAV-447
  5.    \_\_\_ FLUSH at least 15 minutes.

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

- 4.9.15      PERFORM gamma isotopic analysis.
1.    \_\_\_ VERIFY minimum sample flush complete
  2.    REFER to Enclosure 4 for gamma isotopic analysis  
      \_\_\_ SELECT Reactor Building Sump Sample
  3.    \_\_\_ ATTACH gamma scan(s) to this procedure

Gamma Scan ID number(s)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- 4.9.16      ISOLATE grab sample.
1.    \_\_\_ CLOSE CAV-492
  2.    \_\_\_ CLOSE CAV-493

\_\_\_\_\_  
Grab sample Date/Time

**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.9.17 IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

4.9.18 ALIGN for demineralized water flush.

1. OPEN demineralized water supply valves  
\_\_\_ DWV-337  
\_\_\_ CAV-471
2. REQUEST Operations CLOSE sample isolation valves  
[ ] NORMAL RB Sump sample  
\_\_\_ CAV-433  
\_\_\_ CAV-435

OR

- [ ] ALTERNATE RB Sump sample  
\_\_\_ CAV-434  
\_\_\_ CAV-436
3. \_\_\_ Operations REPORTS valves CLOSED
4. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm on CA-74-FI

- 4.9.19 ENSURE adequate system purge.
1. \_\_\_ ENSURE logged onto PASS computer
  2. \_\_\_ ENSURE PASS Menu selected
  3. \_\_\_ SELECT Flush Sample Lines
  4. \_\_\_ SELECT Sump Demin Flush
  5. \_\_\_ FLUSH at least 10 minutes
  6. \_\_\_ PRESS ENTER when flush is complete
  7. \_\_\_ SELECT Quit to exit
  8. \_\_\_ ENTER LO to log off PASS

**NOTE**

CAV-500 is located in the Intermediate Building

- 4.9.20 RESTORE system line-up.
1. \_\_\_ OPEN CAV-447
  2. \_\_\_ CLOSE CAV-445
  3. \_\_\_ CLOSE CAV-446
  4. \_\_\_ FLUSH at least 1 minute
  5. \_\_\_ STOP CAP-8
  6. \_\_\_ STOP CAP-14
  7. \_\_\_ SELECT CAP-10 control switch to OFF
  8. CLOSE demineralized water supply valves
    - \_\_\_ DWV-337
    - \_\_\_ CAV-471
  9. ENSURE CLOSED the following valves
    - \_\_\_ CAV-519
    - \_\_\_ CAV-447
    - \_\_\_ CAV-448
    - \_\_\_ CAV-623
    - \_\_\_ CAV-624
    - \_\_\_ CAV-625
    - \_\_\_ CAV-626
  10. NOTIFY Operations to ENSURE CLOSED the following valves:
    - \_\_\_ CAV-436
    - \_\_\_ CAV-434
  11. \_\_\_ IF ALTERNATE RB Sump sample was obtained,  
THEN CLOSE CAV-500

4.9.21 RESTORE normal configuration.

1.  ENSURE OPEN CAV-439
2.  OPEN CAV-636
3.  SELECT CAP-10 control switch to AUTO

4.9.22 REMOVE Liquid Grab Sampler, CASB-5.

1.  REMOVE liquid grab sampler from sample station, REFER to Enclosure 10
2.  TRANSPORT liquid grab sampler to 95' TB Crane Well
3.  UNBOLT liquid grab sampler from cart using 3/4" wrench or equivalent as determined by Chemistry Technician
4.  INSTALL transit cover over quick connects
5.  MEASURE dose rates from liquid grab sampler

Contact dose rate (side of pig) \_\_\_\_\_ mR/hr

Dose rate @ 3 feet \_\_\_\_\_ mR/hr

4.9.23 PREPARE for liquid grab sample shipment.

REFER to Enclosure 11 for off-site shipment and notifications

\_\_\_\_\_/\_\_\_\_\_  
Section 4.9 complete Initial/Date

4.10 MWST Gamma Isotopic, Boron, or Grab Sample Via CASB-5 Liquid Grab Sampler

- 4.10.1 WHEN sample team exits OSC.  
THEN VERIFY radio communications with OSC Chemistry Coordinator or designee.

**NOTE**

CASB-5 exhaust fan (AHF-55) switch is located to the right of Intermediate Building door (across from RM-A7)

4.10.2 ESTABLISH ventilation for liquid grab sampling.

\_\_\_ POSITION AHF-55 switch to ON

4.10.3 ENSURE liquid grab sampler, CASB-5, installed.

[ ] Liquid grab sampler already installed

OR

[ ] REFER to Enclosure 10 for liquid grab sampler installation instructions

4.10.4 ALIGN system for sample.

1. \_\_\_ SELECT CAP-10 control switch to OFF

2. CLOSE the following valves

\_\_\_ CAV-439

\_\_\_ CAV-636

3. OPEN the following valves

\_\_\_ CAV-519

\_\_\_ CAV-447

\_\_\_ CAV-448

4. POSITION the following valves

\_\_\_ CAV-623 to SAMPLE

\_\_\_ CAV-625 to SAMPLE

\_\_\_ CAV-626 to DRAIN TANK

4.10.5 REQUEST Operations OPEN containment isolation valves.

1. RB Sump return isolation valves

\_\_\_ CAV-436

\_\_\_ CAV-434

2. \_\_\_ Operations REPORTS valves OPEN

4.10.6 ALIGN CAT-8

\_\_\_ SELECT CAP-10 control switch to AUTO

\_\_\_ START CAP-14

4.10.7 ENSURE CAV-701 positioned to PORT 2. This determination was made during the pre-job briefing. If an entry is needed, CAV-701 is located in the PASS room (95' AB) inside CAX-1. CAX-1 is located on LEFT after entering PASS room. CAV-701 is located MIDDLE LEFT inside CAX-1 approximately head high.

4.10.8 OPEN MWST sample isolation valves.

- \_\_\_ CAV-444
- \_\_\_ CAV-443

**NOTE**

Flow downstream of CAV-491 is indicated at CA-50-FS located on countroom mimic panel. The GREEN light indicates NO FLOW. The RED light indicates FLOW.

4.10.9 ADJUST sample flow.

1. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm on CA-74-FI
2. \_\_\_ ENSURE NO FLOW indicated (GREEN light lit) at CA-50-FS flow switch

**NOTE**

Procedure may continue while flushing sample

4.10.10 FLUSH sample lines.

- \_\_\_ FLUSH for at least 5 minutes.

4.10.11 ENSURE PASS AIMS detector CA-54-CE ready for use.

- \_\_\_ REFER to Enclosure 3 for guidance
  - [ ] Liquid nitrogen dewar > 50 pounds
  - [ ] Detector voltage adjusted
  - [ ] QC requirements met

**NOTE**

Gamma isotopic and boron analysis may be performed concurrently with liquid grab sampler flush.

- 4.10.12    **ALIGN** system for liquid grab sample
1.     **ENSURE** minimum sample flush complete
  2.     **OPEN** CAV-445
  3.     **OPEN** CAV-446
  4.     **CLOSE** CAV-447
  5.     **FLUSH** at least 15 minutes.

**NOTE**

The gamma isotopic analysis step may be repeated for multiple gamma analyses.

- 4.10.13    **PERFORM** gamma isotopic analysis.
1.     **VERIFY** minimum sample flush complete
  2.     **REFER** to Enclosure 4 for gamma isotopic analysis  
       **SELECT** Miscellaneous Waste Storage Tank Sample
  3.     **ATTACH** gamma scan(s) to this procedure

Gamma Scan ID number(s)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- 4.10.14    **ISOLATE** grab sample.
1.     **CLOSE** CAV-492
  2.     **CLOSE** CAV-493

\_\_\_\_\_

Grab sample Date/Time

**NOTE**

Boronometer readout normally updates once per 15 minutes.

4.10.15 IF boron analysis is to be performed,  
THEN PERFORM the following:

1. \_\_\_ VERIFY minimum sample flush complete
2. \_\_\_ ENSURE sample flushed through boronometer at least 2 hours
3. \_\_\_ OBSERVE boron concentration at CA-56-CI

Boron Concentration(s)

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

\_\_\_\_\_ ppm

4.10.16 ALIGN for demineralized water flush.

1. CLOSE sample isolation valves.  
   \_\_\_ CAV-443  
   \_\_\_ CAV-444
2. OPEN the following demineralized water supply valves  
   \_\_\_ DWV-337  
   \_\_\_ CAV-471
3. \_\_\_ START CAP-8
4. \_\_\_ THROTTLE CAV-624 to MAINTAIN 0.35-0.50 gpm on CA-74-FI

4.10.17 ENSURE adequate system purge.

1. \_\_\_ ENSURE logged onto PASS computer
2. \_\_\_ ENSURE PASS Menu selected
3. \_\_\_ SELECT Flush Sample Lines
4. \_\_\_ SELECT Sump Demin Flush
5. \_\_\_ FLUSH at least 10 minutes
6. \_\_\_ PRESS ENTER when flush is complete
7. \_\_\_ SELECT Quit to exit
8. \_\_\_ ENTER LO to log off PASS

4.10.18 SECURE line-up.

1. \_\_\_ OPEN CAV-447
2. \_\_\_ CLOSE CAV-445
3. \_\_\_ CLOSE CAV-446
4. \_\_\_ FLUSH at least 1 minute
5. \_\_\_ STOP CAP-8
6. \_\_\_ STOP CAP-14
7. \_\_\_ SELECT CAP-10 control switch to OFF
8. CLOSE demineralized water supply valves
  - \_\_\_ DWV-337
  - \_\_\_ CAV-471
9. CLOSE the following valves
  - \_\_\_ CAV-519
  - \_\_\_ CAV-447
  - \_\_\_ CAV-448
  - \_\_\_ CAV-623
  - \_\_\_ CAV-624
  - \_\_\_ CAV-625
  - \_\_\_ CAV-626
10. NOTIFY Operations to CLOSE the following valves
  - \_\_\_ CAV-436
  - \_\_\_ CAV-434

4.10.19 RESTORE normal configuration.

1. \_\_\_ OPEN CAV-439
2. \_\_\_ OPEN CAV-636
3. \_\_\_ SELECT CAP-10 control switch to AUTO

4.10.20 REMOVE Liquid Grab Sampler, CASB-5.

1. \_\_\_ REMOVE liquid grab sampler from sample station, REFER to Enclosure 10
2. \_\_\_ TRANSPORT liquid grab sampler to 95' TB Crane Well
3. \_\_\_ UNBOLT liquid grab sampler from cart using 3/4" wrench or equivalent as determined by Chemistry Technician
4. \_\_\_ INSTALL transit cover over quick connects
5. \_\_\_ MEASURE dose rates from liquid grab sampler

Contact dose rate (side of pig) \_\_\_\_\_ mR/hr

Dose rate @ 3 feet \_\_\_\_\_ mR/hr

4.10.21 PREPARE for liquid grab sample shipment.

\_\_\_ REFER to Enclosure 11 for off-site shipment and notifications

Section 4.10 complete     /      
Initial/Date

5.0 CONTINGENCIES

5.1 Relief Valve Flow Indicated at CA-50-FS Flow Switch

5.1.1 NOTIFY OSC Chemistry Coordinator, or designee

5.1.2 ENSURE CAV-484 adjusted to maintain the following parameters

- CA-89-PI < 175 psig
- CA-74-FI 0.35-0.50 gpm

5.1.3 IF relief valve(s) are lifting  
AND CANNOT be re-seated,  
THEN PERFORM the following:

- OSC Chemistry Coordinator, or designee, approves continued system operation  
    \_\_\_ CONTINUE with applicable section of this procedure

OR

- PERFORM demineralized water flush and secure PASS per applicable section of this procedure.

Section 5.1 complete \_\_\_\_\_/\_\_\_\_\_  
Initial/Date

5.2 **PASS Temperatures Greater Than Expected**

5.2.1 NOTIFY OSC Chemistry Coordinator or designee

5.2.2 REDUCE sample flow by throttling CAV-484. ENSURE CAV-484 adjusted to maintain the following parameters.

- CA-89-PI < 175 psig
- CA-74-FI 0.35-0.50 gpm

5.2.3 ENSURE relief valves NOT lifting. Flow downstream of relief valves is indicated by CA-50-FS RED light lit.

5.2.4 IF temperatures are greater than expected  
AND CANNOT be adjusted to desired temperatures,  
THEN PERFORM the following:

- OSC Chemistry Coordinator, or designee, approves continued system operation  
    \_\_\_ CONTINUE with applicable section of this procedure

OR

- PERFORM demineralized water flush and secure PASS per applicable section of this procedure.

Section 5.2 complete Initial/Date \_\_\_\_\_/\_\_\_\_\_

5.3 CAT-8 Hi-Hi Level Alarm

5.3.1 ENSURE the following interlock functions occurred:

- CAV-623 indicates CLOSED (green light lit)
- CAV-627 indicates CLOSED (green light lit)
- CAP-10 STOPPED (green light lit)

5.3.2 ENSURE the following control switches positioned as followed:

- CAV-623 selected to CLOSE
- CAV-627 selected to CLOSE
- CAP-10 selected to OFF

5.3.3 PUMP CAT-8.

1. \_\_\_ DEPRESS and HOLD CAT-8 level RESET button
2. \_\_\_ START CAP-10 (control switch to ON position)
3. \_\_\_ CONTINUE depressing CAT-8 level RESET button until CAT-8 HI-HI and HI LEVEL alarms are clear

5.3.4 RESTORE system.

- \_\_\_ POSITION CAV-623 to SAMPLE (if valve was positioned to SAMPLE for section of procedure being performed)
- \_\_\_ POSITION CAV-627 to SAMPLE (if valve was positioned to SAMPLE for section of procedure being performed)
- \_\_\_ SELECT CAP-10 control switch to AUTO

5.3.5 CONTINUE procedure at applicable step.

Section 5.3 complete Initial/Date \_\_\_\_\_/\_\_\_\_\_

5.4 **Estimating Grab Sample Shipment Curie Content When Gamma Spectroscopy System is Unavailable**

5.4.1 ESTIMATE curie content of grab sample.

\_\_\_ REFER to Enclosure 12

Section 5.4 complete     /      
Initial/Date

5.5 **Manual Collimator Positioning and Manual Gamma Isotopic Analysis**

5.5.1 PURGE sample line.

\_\_\_ ENSURE sample line flush complete per applicable gamma spectroscopy section of this procedure

5.5.2 PERFORM gamma isotopic analysis.

1. \_\_\_ POSITION collimator and near line valves manually per Enclosure 13.
2. \_\_\_ PERFORM gamma isotopic analysis manually per Enclosure 13.
3. \_\_\_ RECORD gamma ID number in applicable gamma isotopic analysis section and CONTINUE procedure at that point.

Section 5.5 complete       /        
Initial/Date

TECHNICAL SUPPORT CENTER DATA SHEET

Sample Point

- RC Letdown
- DH
- MWST
- RB Sump

Chemical Analyses

Boron \_\_\_\_\_ ppm      Chloride \_\_\_\_\_ ppm

Hydrogen \_\_\_\_\_ cc/kg      pH \_\_\_\_\_

\_\_\_\_\_  
Initials/Date/Time

Boron \_\_\_\_\_ ppm      Chloride \_\_\_\_\_ ppm

Hydrogen \_\_\_\_\_ cc/kg      pH \_\_\_\_\_

\_\_\_\_\_  
Initials/Date/Time

Boron \_\_\_\_\_ ppm      Chloride \_\_\_\_\_ ppm

Hydrogen \_\_\_\_\_ cc/kg      pH \_\_\_\_\_

\_\_\_\_\_  
Initials/Date/Time

Boron \_\_\_\_\_ ppm      Chloride \_\_\_\_\_ ppm

Hydrogen \_\_\_\_\_ cc/kg      pH \_\_\_\_\_

\_\_\_\_\_  
Initials/Date/Time

\_\_\_\_\_  
OSC Chemistry Coordinator



**Guidelines for Monitoring PASS System Parameters**

1. LOG ON to PASS

LOG ON from CRCHEM

\_\_\_\_\_ ENTER PASS. There is no password

OR

Log on from CHIP

a. LOG ON to CHIP using personal username and password

b. SELECT PASS (CRCHEM) from Main Menu

c. ENTER username PASS. There is no password.

2. SELECT PASS menu

3. SELECT DISPLAY ND68DC INPUT VALUES

**NOTE**

The displayed parameters are not continuously updated. Pressing ENTER updates the displayed parameters with current values.

4. MONITOR the required parameters.

5. WHEN monitoring is complete,  
THEN ENTER Q to quit.

6.  ENTER Y to obtain a hard copy of the parameters and return to PASS Main Menu

OR

ENTER N to return to PASS Main Menu

### PASS AIMS Pre-Analysis Check Guidelines

1. VERIFY dewar weight > 50 as indicated at liquid nitrogen monitor CA-54-LT.

#### CAUTION

AIMS detector CA-54-CE HV supply potentiometer should be adjusted to 0 volts before resetting liquid nitrogen monitor CA-54-LT low level voltage trip or detector damage may occur.

2. ENSURE PASS HV supply voltage adjusted per PASS and RANGE AIMS Equipment Logbook.

#### CAUTION

Increasing detector voltage > 100 volts/second may cause detector damage.

3. IF PASS detector voltage is secured,  
THEN ADJUST detector voltage as follows:
  - a. ENSURE CA-54-CE HV supply voltage potentiometer adjusted full counterclockwise
  - b. DEPRESS liquid nitrogen monitor CA-54-LT HV RESET button.
  - c. DEPRESS CA-54-CE HV supply voltage RESET button.
  - d. ENSURE CA-54-CE HV supply power switch selected to ON position
  - e. ADJUST CA-54-CE HV supply voltage per PASS and RANGE AIMS Equipment Logbook.
  - f. LOCK CA-54-CE voltage potentiometer at correct voltage reading

4. ENSURE calibration check completed.

- Calibration Check completed within past 7 days

OR

- PERFORM calibration check per CH-234, Post Accident Sampling System Gamma Spectroscopy System.

**Guidelines for Performing Gamma Spectroscopy Analysis**

1. LOG ON to PASS

LOG ON PASS from CRCHEM

ENTER username PASS. There is no password.

OR

LOG ON PASS from CHIP

a. LOG ON to CHIP using personal username and password

b. SELECT PASS (CRCHEM) from Main Menu

c. ENTER username PASS. There is no password.

2. SELECT PASS menu

3. SELECT Liquid Sampling

4. SELECT sample point based on section of procedure being performed

5. IF system parameters are displayed (MUX display),

THEN ENTER Q to quit

AND ENTER N at prompt for aborting sample

**NOTE**

The default sample parameters are normally used. Sample time and volume are automatically updated by software. Specific parameters may be edited as needed on a case by case basis.

6. UPDATE sample parameters

7. SELECT ACCEPT

## ASSESSMENT OF CORE DAMAGE BASED ON REACTOR COOLANT SAMPLE

### Assumptions and Limitations

1. Use of RCS sample results to estimate the extent of core damage is subject to significant uncertainties. Many orders of magnitude error are possible due to factors such as:
  - fraction of an isotope assumed to be released from the fuel matrix
  - homogeneity of the activity in the RCS
  - whether or not sample is representative
  - effects of removal mechanisms
2. Given the possible magnitude of the above errors, no corrections are made for the following minor factors:
  - Radioactive decay (longer half-life nuclides chosen to minimize error)
  - Dilution volume (assumes CFT's have discharged and BWST injection to low alarm setpoint)
  - RCS temperature and density corrections
  - Reactor power history (assumes end of cycle activities for long lived nuclides and assumes shorter lived nuclides at equilibrium)
  - Release from the RCS. Nuclides chosen should remain in RCS (noble gases not included)
3. Appropriate corrections may be applied if desired. For example, if no water has been added from the CFT's or BWST, then results could be reduced by a factor of 5.5 (510,000 lb RCS mass vs. 2,800,000 lb mass RCS, BWST and CFT's)

### Estimating Core Damage

1. COMPLETE Table 1.
2. REPORT results to Radiation Controls Coordinator and Accident Assessment Team

## ASSESSMENT OF CORE DAMAGE BASED ON REACTOR COOLANT SAMPLE

DATE/TIME OF RCS SAMPLE: \_\_\_\_\_ DATE/TIME OF RX SHUTDOWN: \_\_\_\_\_

Table 1									
Nuclide	(A) Sample Result ( $\mu\text{Ci/ml}$ )	(B) Factor	(C) Curies in RCS (A)x(B)	(D) Core Inventory (Ci)	(E) Fractional Release to RCS (C)+(D)	(F) Expected Gap Fraction	% Clad Failure (Note 1) 100x(E)+(F)	(G) Expected Fraction 100% Melt	% Fuel Melt/ Overheat 100x(E)+(G)
I-131		1300		6.7E7		0.05		0.4	
Cs-134		1300		8.9E6		0.05		0.3	
Cs-137		1300		5.0E6		0.05		0.3	
Te-132		1300		9.7E7		0	NA	0.05	
Ru-103		1300		9.4E7		0	NA	0.0025	
Ba-140		1300		1.3E8		0	NA	0.02	
Ce-144		1300		7.1E7		0	NA	0.0005	
Np-239		1300		1.3E9		0	NA	0.0005	

Note 1: Enter 100% if greater than 100%

\_\_\_\_\_  
OSC Chemistry Coordinator Initial/Date

## Guidelines for Operating EG&G Flow Technology Flow Meters

### Zeroing flow totalizer

DEPRESS RESET button

### Displaying Totalizer Reading

DEPRESS TOTAL (number 1) button. Total volume (gallons) is displayed

### Displaying Flow Rate Reading

DEPRESS RATE (number 3) button. Flow rate (gpm) is displayed

### Displaying both Totalizer and Flow Rate Readings

DEPRESS DISPLAY (number 0) button to display both total volume (gallons) and flow rate (gpm)

## Guidelines for Orbisphere Model 2643 Hydrogen Analyzer Operation

### NOTE

Hydrogen readings are displayed in cc/kg. An indicated reading of "c/kg" is just an abbreviation of cc/kg.

#### Changing Readout Display

1. ENSURE key selected to ON position.
2. DEPRESS MAIN MENU button.
3. DEPRESS UP or NEXT button until desired readout description is flashing.
  - MEASURMNT: L-H2 & H-H2
  - MEASURMNT: L-H2 ONLY
  - MEASURMNT: H-H2 ONLY
4. DEPRESS GO button.

## Guidelines for Leeds & Northrup pH Meter Operation

### Manual Scan Mode

DEPRESS pH/ORP/TEMP button to toggle between modes of operation. Operating mode is indicated on the display as follows:

- pH mode – indicates pH on right side of display
- Temperature mode – indicates °C on right side of display
- Time mode (if activated) – indicates 1 (A.M.) or 2 (P.M.) on upper left side of display

### Hold Mode

DEPRESS HOLD button to toggle between hold mode and manual scan mode. Hold mode is indicated by HOLD displayed on lower left corner of display.

Hold mode disables temperature compensation and is not used for sample measurement.

Hold mode automatically de-activates after 20 minutes.

### Auto-Scan Mode

The AUTO-SCAN mode cycles between pH, temperature, and time (if activated).

To start AUTO-SCAN mode, DEPRESS pH/ORP/TEMP button and UP arrow simultaneously.

To exit AUTO-SCAN mode, DEPRESS pH/ORP/TEMP button. This action returns display to manual scan mode.

## Guidelines for PASS Ion Chromatograph Operation

### Instrument Set-up

1. ENSURE the following:
  - IC plugged into 120 Vac outlet
  - Analytical pump discharge tubing connected to analytical pump outlet
  - Eluent supply tubing connected to appropriate analytical pump inlet manifold valve bulkhead fitting on ANALYTICAL PUMP module
  - Reagent water supply tubing connected to appropriate analytical pump inlet manifold valve bulkhead fitting on ANALYTICAL PUMP module
  - Integrator CH A input cable connected to CHART RECORDER output at back of CONDUCTIVITY DETECTOR Module
  - Integrator power cord plugged into IC power strip outlet
  - Integrator POWER switch ON
  - Cell Drive cable connected
  - Cell Return cable connected
  - Cell Thermistor cable connected
  - Solenoid power supply connected
  - Nitrogen supply tubing connected from PASS IC ELUENT pressure regulator to eluent and reagent water reservoirs
2. DEPRESS POWER button to start IC

#### NOTE

Other regenerate, eluent, and chloride standard concentrations may be used based on specific situation.

### Reagent and Standard Preparation

Regenerate (25 mN H<sub>2</sub>SO<sub>4</sub>)

Dilute 2.8 mL concentrated H<sub>2</sub>SO<sub>4</sub> per 4L reagent water

Eluent (5 mM Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>)

Dissolve 1.91 g Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>·10H<sub>2</sub>O per 1 L reagent grade water

Chloride Calibration and QC standards

- Calibration standard 100 ppb Cl
- QC standard 50 ppb Cl

**Guidelines for PASS Ion Chromatograph Operation**  
(continued)

IC Reservoir Preparation

- Eluent level at least 2L (on IC cart). Eluent pressure approximately 5 psig at PASS IC ELUENT pressure regulator
- Reagent water at least 2L (IC cart)
- Regenerate level approximately 4L (Chloride Interface Panel). Regenerate pressure approximately 5 psig at PASS IC REGENERATE pressure regulator
- Reagent water approximately 1L (Chloride Interface Panel)
- Calibration standard at least 500 mL (Chloride Interface Panel)
- QC standard at least 500 mL (Chloride Interface Panel)

CONDUCTIVITY DETECTOR Module Set-up

ENSURE the following:

- LOCAL/REMOTE selected to LOCAL
- CELL selected to ON
- AUTO OFFSET selected to OFF
- TEMPERATURE COMPENSATION adjusted to 1.7
- OUTPUT RANGE selected to appropriate range. REFER to 2010i Equipment Logbook

ANALYTICAL PUMP Module Set-up

ALIGN eluent to analytical pump suction

- OPEN analytical pump inlet manifold eluent supply valve (valve LED lit)
- ENSURE other analytical pump inlet manifold supply valves closed (valve LED's NOT lit)

ENSURE the following:

- LOCAL/REMOTE selected to LOCAL
- LOW PRESSURE ALARM set at 20 psig
- HIGH PRESSURE ALARM set approximately 200 psig above instrument operating pressure (normally ???? psig). REFER to 2010i Equipment Logbook
- FLOW adjusted to appropriate flow rate (normally 2.0 mL/min). REFER to 2010i Equipment Logbook

ADVANCED CHROMATOGRAPHY Module Set-up

ENSURE the following:

- SYS 2 LOCAL/REMOTE selected to LOCAL
- SYS 2 LOAD/INJECT selected to LOAD
- SYS 2 A VALVE selected to A OFF
- SYS 2 B VALVE selected to B OFF

Guidelines for PASS Ion Chromatograph Operation  
(continued)

Analytical Pump Start-up

**NOTE**

Analytical pump LOW PRESSURE ALARM setpoint may be temporarily lowered until pump start-up is completed and stable system pressure observed.

**NOTE**

Analytical pump may require priming if system has been shut down for extended period of time.

1. START analytical pump.
2. WAIT until pressure is stable (pump READY LED lit).

Analytical Pump Priming

1. STOP analytical pump
2. CONNECT syringe to analytical pump block valve.
3. OPEN block valve.
4. Partially WITHDRAW syringe plunger to remove air from pump cylinders.
5. DISCONNECT syringe from block valve.
6. REMOVE air from syringe.
7. CONNECT syringe to analytical pump block valve.
8. LOOSEN analytical pump discharge tubing 2 turns
9. INJECT syringe contents into block valve.
10. TIGHTEN analytical pump eluent discharge tubing
11. CLOSE block valve and DISCONNECT syringe.
12. START analytical pump.

Integrator Set-up

ENTER appropriate file number for PASS chloride per 2010i Equipment Logbook by entering FI=n where n is the file number.

OR

Manually ENTER integrator parameters using integrator dialog function. Parameters are listed in 2010i Equipment Logbook.

**Guidelines for PASS Ion Chromatograph Operation**  
(continued)

Calibration

1. ENSURE conductivity is stable ( $< 0.02 \mu\text{S}$  change per minute).
  2. ENSURE SYS 2 LOAD/INJECT valve selected to LOAD.
  3. PLACE calibration pump suction tubing in calibration standard (at Chloride Interface Panel).
  4. POSITION Calibration Pump Supply Valve to CALIB SAMPLE (at Chloride Interface Panel).
  5. START calibration pump (at Chloride Interface Panel).
  6. FLUSH at least one minute.
  7. STOP calibration pump (at Chloride Interface Panel).
  8. ZERO conductivity using AUTO/OFFSET button
  9. Simultaneously SELECT SYS 2 LOAD/INJECT valve to INJECT and DEPRESS integrator INJ/END-A button.
  10. CALCULATE RF value by dividing peak area by calibration standard concentration
  11. UPDATE integrator RF and RT values by entering the following commands into the integrator:
    - $\text{RF}(n) = \text{calculated RF value}$
    - $\text{RT}(n) = \text{peak retention time}$
- Where n is the file number for the integrator file in use
12. PERFORM QC check.

QC Check

1. ENSURE system conductivity is stable ( $< 0.02 \mu\text{S}$  change per minute).
2. ENSURE SYS 2 LOAD/INJECT valve selected to LOAD.
3. PLACE calibration pump suction tubing in QC check standard (at Chloride Interface Panel).
4. POSITION Calibration Pump Supply Valve to CALIB SAMPLE (at Chloride Interface Panel).
5. START calibration pump (at Chloride Interface Panel).
6. FLUSH at least one minute.
7. STOP calibration pump (at Chloride Interface Panel).
8. ZERO conductivity using AUTO/OFFSET button.
9. Simultaneously SELECT SYS 2 LOAD/INJECT valve to INJECT and DEPRESS integrator INJ/END-A button
10. ENSURE QC check standard result is  $\pm 25\%$  of expected value.

**Guidelines for PASS Ion Chromatograph Operation**  
(continued)

Sample Analysis

1. ENSURE SYS 2 LOAD/INJECT valve selected to LOAD
2. ENSURE SYS 2 B VALVE selected to B OFF (RCS loading at this time)
3. LOAD sample at least 5 minutes
4. ENSURE conductivity stable ( $< 0.02 \mu\text{S}$  change per minute)
5. ZERO conductivity display using AUTO/OFFSET button
6. Simultaneously SELECT SYS 2 LOAD/INJECT valve to INJECT and DEPRESS INJ/END-A button on integrator

Shutdown

1. ALIGN system for shutdown
  - SYS 2 B valve selected to B ON
  - SYS 2 LOAD/INJECT valve selected to LOAD
  - SYS 2 A valve selected to A OFF
2. STOP analytical pump
3. ENSURE all analytical pump inlet manifold valves CLOSED (LED's NOT lit)
4. DEPRESS POWER button to turn off power
5. IF system is to be disconnected,  
THEN PERFORM the following:
  - DISCONNECT cell drive cable
  - DISCONNECT cell return cable
  - DISCONNECT cell thermistor cable
  - DISCONNECT solenoid power supply cable
  - DISCONNECT analytical pump discharge tubing
  - ADJUST PASS IC ELUENT pressure regulator to 0 psig and LOOSEN reservoir cap
  - DISCONNECT NITROGEN SUPPLY tubing from PASS IC ELUENT pressure regulator
  - ADJUST PASS IC REGENERATE pressure regulator and LOOSEN reservoir cap

## Guidelines for Liquid Grab Sampler Installation and Removal

### Installation

**NOTE**

Grab sampler preparation is normally done in a low dose area.

1. PREPARE grab sampler
  - a. ENSURE grab sampler bolted to grab sampler cart
  - b. ENSURE transit cover removed from grab sampler
  - c. STORE transit cover by attaching to lifting ring on grab sampler with break-away type device.
  - d. OPEN CAV-492
  - e. OPEN CAV-493
2. INSTALL grab sampler
  - a. ENSURE ramp installed
  - b. GUIDE grab sampler into sample station until sampler is within several inches of connection point
  - c. CONTINUE to GENTLY guide grab sampler until fully inserted into sample station
  - d. ENGAGE Cart to Station Lock
  - e. GENTLY PULL Engagement Handle to connect quick connects
  - f. DISENGAGE Cart to Station Lock
  - g. ENSURE grab sampler moves when Engagement Handle is moved back and forth.
  - h. ENGAGE Cart to Station Lock

### Removal

1. ENSURE ramp installed
2. SQUEEZE Engagement handle lever and PUSH to engagement handle toward wall
3. DISENGAGE Cart to Station Lock
4. REMOVE grab sampler from sample station

## Grab Sample Shipment and Notifications

**NOTE**

Notifications may be made in any order.

1. NOTIFY Superintendent, Nuclear Operations Materials Controls
  - A grab sample has been collected
  - INITIATE acquisition process for shielded sample cask
2. NOTIFY RNP E&C Superintendent that a grab sample has been collected
3. The following information is needed:
  - Utility and plant name
  - Name and phone number of E&C Specialist to whom follow-up communication should be addressed
  - Number and type of samples being shipped
  - Measured radiation levels at surface and three feet from shipping container
  - Estimated shipping time
  - Mode of transportation
  - Carrier
  - Estimated time of arrival at RNP in Hartsville, SC
4. USE the following shipping address:
  - Progress Energy Carolinas
  - Robinson Nuclear Plant
  - 3581 West Entrance Road
  - Hartsville, SC 29990
  - Attn: E&C Superintendent
  - Phone (Caronet) 450-1837

**Estimating Grab Sample Curie Content When Gamma Spectroscopy System is Unavailable**

1. DETERMINE which of the following best represents the sample. Emergency Response support personnel may be used to make this determination

**Pressurized Liquid Sample**

Fuel Gap Release – use column A

OR

Fuel Melt Release – use column B

**Depressurized Liquid Sample**

Fuel Gap Release- use column C

OR

Fuel Melt Release- use column D

2. RECORD Contact Dose Rate (side of pig) from the grab sample, CASB-5.

Contact Dose Rate (side of pig) \_\_\_\_\_ mR/hr

3. DETERMINE  $\mu\text{Ci}$  per mR/hr

**Pressurized Liquid Sample**

Fuel Gap Release =  $2.00\text{E}+4$   $\mu\text{Ci}$  per mR/hr

OR

Fuel Melt Release =  $2.50\text{E}+4$   $\mu\text{Ci}$  per mR/hr

**Depressurized Liquid Sample**

Fuel Gap Release =  $1.50\text{E}+4$   $\mu\text{Ci}$  per mR/hr

OR

Fuel Melt Release =  $1.50\text{E}+4$   $\mu\text{Ci}$  per mR/hr

4. CALCULATE total activity.

*Total Activity = Contact Dose Rate (side of pig) x  $\mu\text{Ci}$  per mR/hr*

Total Activity \_\_\_\_\_  $\mu\text{Ci}$

5. CALCULATE individual nuclide activity. RECORD results in Table 1.

*Individual Nuclide Activity = Total Activity x nuclide fraction of total activity*

TABLE 1

Nuclide	Column A		Column B		Column C		Column D	
	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )
Co58			5.97E-06				1.47E-05	
Co60			4.58E-06				1.13E-05	
Kr85	1.22E-03		1.84E-03					
Kr85m	1.65E-02		2.49E-02					
Kr87	1.34E-03		2.02E-03					
Kr88	2.00E-02		3.01E-02					
Rb86	9.19E-05		4.16E-05		1.51E-04		1.02E-04	
Sr89			5.31E-03				1.30E-02	
Sr90			2.88E-04				7.07E-04	
Sr91			3.83E-03				9.40E-03	
Sr92			9.24E-04				2.27E-03	
Y90			2.83E-06				6.96E-06	
Y91			6.48E-05				1.59E-04	
Y92			1.49E-05				3.66E-05	
Y93			4.69E-05				1.15E-04	
Zr95			8.19E-05				2.01E-04	
Zr97			6.17E-05				1.51E-04	
Nb95			7.72E-05				1.89E-04	
Mo99			1.04E-03				2.56E-03	
Tc99m			3.90E-04				9.57E-04	
Ru103			8.39E-04				2.06E-03	
Ru105			1.58E-04				3.87E-04	
Ru106			1.92E-04				4.71E-04	
Rh105			3.25E-04				7.98E-04	
Sb127			9.76E-04				2.40E-03	
Sb129			1.02E-03				2.51E-03	
Te127			5.53E-04				1.36E-03	
Te127m			1.32E-04				3.25E-04	

TABLE 1 (continued)

Nuclide	Column A		Column B		Column C		Column D	
	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu\text{Ci}$ )
Te129			2.91E-05				7.14E-05	
Te129m			9.02E-04				2.21E-03	
Te131m			1.45E-03				3.55E-03	
Te132			1.61E-02				3.96E-02	
I131	1.54E-01		9.27E-02		2.53E-01		2.28E-01	
I132	2.09E-02		1.26E-02		3.44E-02		3.10E-02	
I133	2.56E-01		1.54E-01		4.22E-01		3.79E-01	
I134	6.63E-04		4.00E-04		1.09E-03		9.82E-04	
I135	1.36E-01		8.22E-02		2.24E-01		2.02E-01	
Xe133	3.20E-01		4.82E-01					
Xe135	3.41E-02		5.14E-02					
Cs134	2.13E-02		9.64E-03		3.51E-02		2.37E-02	
Cs136	6.37E-03		2.88E-03		1.05E-02		7.08E-03	
Cs137	1.19E-02		5.39E-03		1.96E-02		1.32E-02	
Ba139			1.67E-04				4.10E-04	
Ba140			9.08E-03				2.23E-02	
La140			8.23E-05				2.02E-04	
La141			2.10E-05				5.16E-05	
La142			2.29E-06				5.62E-06	
Ce141			2.09E-04				5.12E-04	
Ce143			1.73E-04				4.24E-04	
Ce144			1.26E-04				3.11E-04	

TABLE 1 (continued)

Nuclide	Column A		Column B		Column C		Column D	
	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu$ Ci)	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu$ Ci)	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu$ Ci)	Nuclide Fraction of Total Activity	Individual Nuclide Activity ( $\mu$ Ci)
Pr143				7.89E-05				1.94E-04
Nd147				3.51E-05				8.62E-05
Np239				2.18E-03				5.35E-03
Pu238				1.36E-07				3.34E-07
Pu239				3.07E-08				7.54E-08
Pu240				3.87E-08				9.51E-08
Pu241				6.52E-06				1.60E-05
Am241				1.72E-09				4.23E-09
Cm242				6.59E-07				1.62E-06
Cm244				3.86E-08				9.48E-08

## Manual Collimator Positioning and Manual Gamma Isotopic Analysis

### NOTE

Starting with FAR CLOSED and progressively trying more efficient geometries is recommended but not required.

1. POSITION collimator and near line valves per Table 2 until one of the following criteria is met:
  - adequate count rate observed at CA-54-CE rate meter
  - NEAR OPEN position lined up with adequate count rate
  - OSC Chemistry Coordinator or designee determines geometry to be used
2. Manually PERFORM gamma spectroscopy analysis.

NOTE

The collimator position lights represent binary code. The 1, 2, and 3 lights may be disregarded when manually positioning the collimator. These lights represent a total of 7 binary units which is <10% of total collimator movement.

Table 2

Geometry	Binary Code Target	CA-54-CX Collimator Position Lights Lit	Near Line Valve Position				
			RCS AIMS		SUMP AIMS		
			CAV-514	CAV-517	CAV-546	CAV-549	
RCS	Far Closed	258	1,2,9	CLOSED	CLOSED		
	Far Open	101	3,6,7	CLOSED	CLOSED		
	Near Closed	210	3,5,7,8	OPEN	OPEN		
	Near Open	51	3,5,6	OPEN	OPEN		
SUMP	Far Closed	706	1,7,8,10			CLOSED	CLOSED
	Far Open	868	1,3,6,7,9,10			CLOSED	CLOSED
	Near Closed	670	1,2,3,4,5,8,10			OPEN	OPEN
	Near Open	826	3,4,5,6,9,10			OPEN	OPEN

## Revision History

1. Reformatted entire procedure to current writer's guide.
2. Updated position titles throughout the procedure.
3. Step 4.6.16 – There are two Step 5's. Changed second one to 6 and then Step 6 became Step 7.
4. Changed Section 2.2 Equipment to Equipment Database References.